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AERIAL AGE

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Shall Britannia Rule the Air?

Army Air Service Promotion

Detroit's Aerial Contests

The Berliner Helicopter

Remarkable Performance of the Loening Air Yacht

Commercial and Military Aeronautics

A Challenge to the World

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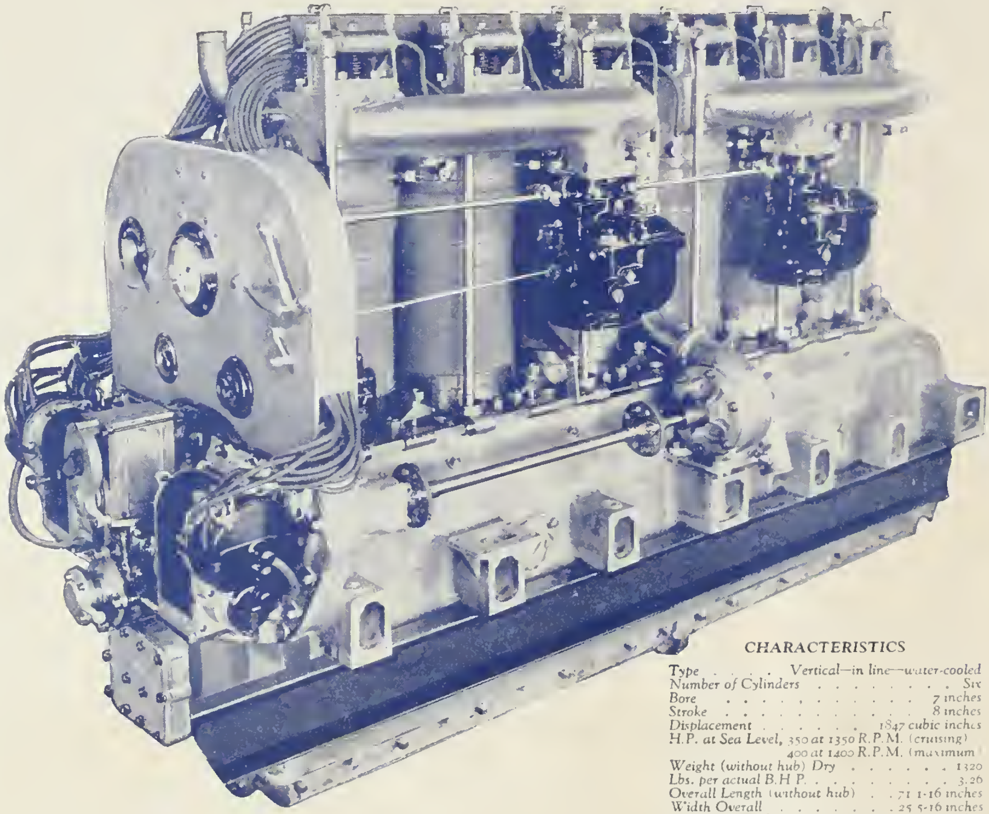

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Number of Cylinders	*Six*
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Stroke	*8 inches*
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Lbs. per actual B.H.P.	*3.26*
Overall Length (without hub)	*71 1-16 inches*
Width Overall	*25 5-16 inches*
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PUBLISHED MONTHLY BY THE AERIAL AGE COMPANY, Inc., 5942 GRAND CENTRAL TERMINAL, NEW YORK CITY
Subscriptions: Domestic, $3; Foreign, $5. Entered as second-class matter, March 25, 1915, at the Post Office at New York, under the Act of March 3rd, 1879.

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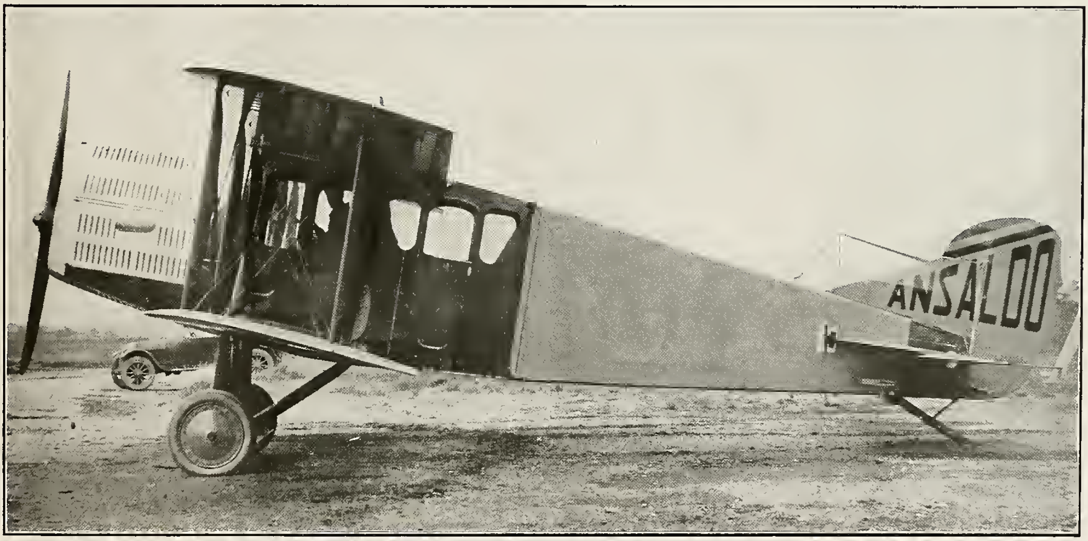

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Commercial and Military Aeronautics

By WILLIAN KNIGHT, M. E.

SEVERAL criticisms have been made from time to time on the matter of the more or less perfect adaptation of the military flying machine which was practically born and developed during the war to the needs of post-bellum commercial aviation.

"The Commercial aeroplane does not exist in America" was the surprising statement attributed to one of our best flyers a few weeks ago after unsuccessfully attempting a cross-country flight on a good machine which has successfully stood the more severe tests both in Germany where it was born and in this country where it has been adopted by Larsen.

It is out of question that the commercial aeroplane of to-day is far as yet from being the ideal means of transportation in the air, but this is not a good reason for condemning the present day commercial aircraft and for casting a shadow of doubt on its present and future possibilities.

So far as commercial aviation expenditures, even in France where the Government has taken an active interest in its development that has not been equalled by any other government, have stood a very poor comparison with military aviation expenditures. Two hundred and forty-six millions of francs for military aviation and forty-five millions for commercial aviation are such figures that explain quite eloquently why the military flying machine has progressed since the war at such a rate which cannot be compared to the progress made by commercial aircrafts.

To this country, the comparison is even more discouraging because the only money that we are opening at the present time for commercial aviation is the money which is being spent for keeping alive what remains of our air mail service.

The development of a truly commercial aircraft, quite evidently requires money. Aircraft manufacturers in this country are not generally inclined to invest large sums of money in experimental machines radically new, without any subsidy being paid by the government for that purpose.

Aircraft manufacturers in Europe are doing their best to develop new commercial types of aircraft in spite of the fact that they find themselves seriously handicapped by some features that they have to include in their designs in order to be able to collect from their governments those subsidies that they cannot afford to dispense with at the present time.

On the other hand, however, if the aerial operating companies in Europe had waited for the perfect commercial aircraft to make its appearance before starting operation, nobody at the present time would be flying from Paris to Casablanca and to Warsaw in twenty-four hours and from Paris to Constantinople in two and a half days.

If marine, automotive and railroad engineers had seeked the perfection before attempting operating engines that they knew quite well had to be further developed and perfected, we would have never had the steamship, the automobile and the railroad train, because the only way how to perfect a mechanism is to use it first as it is and see after what is needed to improve upon it.

In 1911 after the raid made by Paulhan d'Orleans at Arcis-sur-Aube somebody suggested to a well known high rank French officer who was in charge of aeronautical developments at the Ministry of War, that the time had come for organizing some military air squadrons, the answer was: "Wait, wait, do not run so fast with your imagination; the aeroplane is far as yet from being in such a shape as to warrant its use in the army." And this happened only three years before the war started.

If we had waited for development of ballistics before building and using guns we would probably have now the same armament which was used by the Indians.

Thirty-five years were needed before reaching the present stage of development of the steam locomotive, twenty years were required to perfect the marine engine and fifteen years have been spent in perfecting the automobile. Do the critics of present day commercial aviation propose to wait twenty years before considering the aeroplane as a safe and efficient means of transportation?

Such critics are ready to concede that the aeroplane is an efficient war engine, but connot separate in their mind the military from the commercial arcraft. This is an error. The divorce of commercial aviation from military aviation is absolute, and it has been recently sanctioned in the note sent by the allies to Germany concerning the resumption of German commercial aeronautical activities which, it has been decreed by the allies, must be based on the following conditions to be fulfilled by the German aircraft manufacturers: Ceiling 4,000 meters; speed at 2,000 meters altitude, 170 kilometers per hour; fuel for 3 hours flight: useful load 600 kg.

These conditions very nearly represent the average present state of affairs in commercial aviation and mark the beginning of the application of a sound economical regime for commercial aircraft.

Military aviation, on the other hand is progressing along an entirely different road: a pursuit aeroplane must be able to climb rapidly to 25,000 or 33,000 feet altitude and fly horizontally at 170 miles per hour; a bombing aeroplane must also be able to climb up to high altitudes with several tons of bombs on board and must be able to cover without stopping 500 miles or more.

At first sight the bombing aeroplane seems to be the best type which can be adapted to commercial exploitation. It is very often stated that the price of the ton-mile decreases with the increase of the load carried. These conclusions are arrived at through the mistake which is often made of comparing the aeroplane to a ship. A ship floats on the water without any need of motive power. while instead an aeroplane needs motive power in order to sustain itself in the air. Also the ratio between useful load and total load of a ship, for the same speed, increases with the dimensions of the ship whereby in an aeroplane this ratio remains practically constant.

An average attained by figuring on the characteristics of all sorts of aeroplanes, except scouting aeroplanes, shows that the load lifted by the present day flying machines is from 14 to 16 lbs. per h.p. or from 9 to 11 lbs. per square foot of lifting surface irrespective of the dimensions.

These are the fundamental basis which determine the separation of military and commercial aviation and it is an error to assume the interdependence existing between these two well defined and entirely separate phases of aerial navigation.

To talk about building commercial aircraft which in case of a national emergency can be efficiently adapted to military uses is a very optimistic talk. Of the 598 commercial aeroplanes now in use in France only a very small percentage could be used for military purposes and this fact is well recognized by French and other aeronautical experts.

We think that these facts should be stated and that it should be dispelled the delusion under which we are inclined to live that by developing commercial aeroplanes which represent a compromise between commercial and military exploitation we are helping to build a powerful aerial defense at the same time that we provide for a fleet of efficient aerial commercial carriers.

The problems of military and commercial aeronautics are entirely separate the ones from the others and to put commercial aeronautics in this country under the control of military aeronautics as is the case in France, for instance, would be a mistake. What we need is a department of aeronautics, separate from both the Navy and the War Departments which will consider the problems of civil aviation from an entirely civilian standpoint.

But above everything else what we need now is to stop talking about commercial aviation and the limitation of present day commercial aeroplanes and start operating commercial lines with whatever commercial flying equipment we have at the present time. This is the only way that we can ever hope to develop aeroplanes well adapted to commercial uses.

Aircraft manufacturers who at the present time are living on government jobs will give to us the commercial aeroplanes that we need if we can show them that there is a field for such a production. We cannot expect aircraft manufacturers to design and build for us such aeroplanes without any subsidy on the part of the Government and without any organized commercial activities in this country.

Let us get busy, let us start doing something constructive for establishing civil aviation in the United States on sound business basis.

Remarkable Performance of the Loening Air Yacht

THE Loening Aeronautical Engineering Corporation delivered the air yacht ordered by Mr. Vincent Astor on schedule time, with no delays whatsoever, and the machine was flight tested by David H. McCulloch at Port Washington on June 19th and 20th, so that Mr. Astor, on his return from Europe on June 23rd, found his machine entirely ready for him.

He arrived on the Mauretania about eleven o'clock in the morning and after spending some time in the city, motored to Port Washington, and flew on his air yacht in about 50 minutes to New London, arriving there in ample time to see the Yale-Harvard boat races.

No other means of travel could have accomplished this result.

Several of Mr. Astor's guests took flights in the new machine after its arrival—a party of them returning to New York quite late the same night, arriving after dark.

Clifford Webster is pilot of the Astor Air Yacht and on June 26th flew up to Poughkeepsie with Mr. Astor and a party to attend the intercollegiate boat races there. The trip from New York to Poughkeepsie was made in about 50 minutes, and the return trip in about 40 minutes—most of the trips being made at a cruising speed in the neighborhood of 110 miles an hour.

The Astor Air Yacht differs only in detail from the original model of the Loening Air Yacht. The seating arrangement has been modified and a complete dual control system installed as Mr. Astor will fly the machine himself from time to time. The door to the cabin, formerly on the side, has been placed in the bow, and many detail arrangements, such as the anchor and other equipment, have been greatly improved upon.

Special lockers for goggles, helmets, etc., have been provided.

Structurally the new flying boats are virtually the same, with the exception that the wings themselves have been increased in area, and in the interior of which all metal fittings have been doubled in thickness in order to give ample margin for the possibility of rusting.

The bottom of the hulls are made of an aluminum alloy, treated inside and out with a special marine glue preparation to prevent deterioration from salt water.

The new machines also have a larger gasoline capacity—Mr. Astor's air yacht carrying enough fuel to fly it non-stop for 500 miles.

The finish of the Astor machine is, of course, specially chosen by the owner. The color is a light grey, with dark grey finishing lines. The wings are treated with pigmented aluminum colored dope and the interior of the cabin is fitted with blue leather upholstery and light varnish woodwork finish.

The owner's private signal—a red star on a white field—flies at the mast, which also serves to hold the speed indicator tubes.

The instrument equipment is complete with compass, drift indicator, gas and oil pressure gauges, thermometers, tachometer, altimeter, air speed meter, etc.

The actual delivery of Mr. Astor's Air Yacht was of considerable interest, because the Loening plant, where this machine was constructed, is equipped with special Ogden type doors which, when raised up, form a clear opening 46 feet wide and 18 feet high. This is the largest opening in any building on Manhattan Island. It was thus possible, after the final assembly of Mr. Astor's machine in the factory, to wheel it out of the doors and on to the dock, where it was hoisted aboard a lighter and brought to Port Washington completely set up and ready for its initial flight tests. This is the first time that a fully set up aeroplane ready for flight has been brought out of a building in New York City.

There has been a great deal of flying lately on the Loening Air Yacht in this vicinity.

One of the most interesting experiences in this connection was had recently by Mr. Harold S. Vanderbilt, Commodore of the New York Yacht Club.

Mr. Vanderbilt has been flying with Mr. David H. McCulloch on the Loening Air Yacht ever since its return from Palm Beach and has made many trips, some as far as Marblehead, Mass. The following schedule, all done in one day, shows the remarkable ability of machines of this kind to cover long distances.

On Monday, June 26th, Mr. Vanderbilt played 18 holes of golf at the National Golf Links at Southampton, Long Island. He left there, accompanied by three friends, at about 12:30, with Harry Rogers piloting the Loening Air Yacht, and landed at 82nd street and the Hudson river in 52 minutes. This is a distance of approximately 95 miles, so that the average cruising speed was about 120 miles an hour.

The party lunched at the Columbia Yacht Club and then went to the Polo Grounds to attend the Yale-Harvard baseball game, leaving the Air Yacht anchored in the river. They stayed until the end of the game and then returned to the Columbia Yacht Club, where they again boarded the plane and proceeded to fly to Poughkeepsie to attend the 'varsity boat races, arriving there in time to see the entire race.

The party left Poughkeepsie about 7:15 and arrived at Port Washington, Long Island, about 45 minutes later, in time for dinner on Long Island.

Mr. Vanderbilt has ordered a Loening Air Yacht for his own use and this machine will be delivered to him about the middle of July and will be piloted by Harry Rogers.

A Challenge to the World

A CABLE dispatch to the Air Ministries of Great Britain, France, Italy, Spain, Portugal, Belgium, Norway, Sweden, Denmark, Cuba, Mexico, Brazil, Argentine Republic, Chile, Peru, Japan and China, over the signature of Rear Admiral Bradley A. Fiske, U. S. N. retired, challenged the aeronautical engineers and sportsmen of those powers to enter into a competition with a similar American group to circumnavigate the world with a commercial hydroaeroplane of one hundred passenger capacity.

This action disclosed the fact that a large group of American engineers have reached the conclusion that the era of commercial navigation on a big scale is at hand and that they have carried experimentation to a point where the design of the American entry for such a competition has been tacitly accepted. Details for financing and building the enormous flyer have been worked out and the group is prepared to put their scientific conclusions to a practical test by precipitating the international contest.

The challenge to Great Britain, of which those to the other countries are practically duplicate, follows:

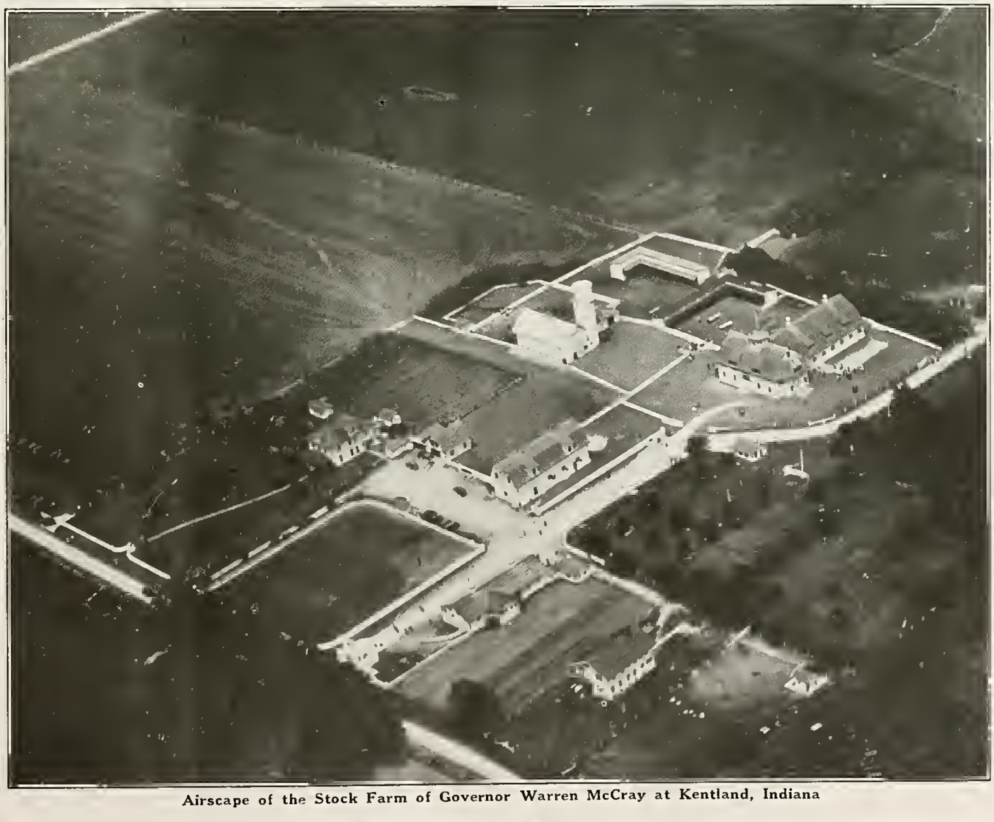
"Please convey to representative group of British aeronautical engineers and sportsmen the compliments of American group affiliated in the project to build hydroaeroplane of hundred passenger capacity to circumnavigate the world for advancement of commercial aerial navigation. Stop. Also please convey friendly challenge to compete with British ship. Stop. Conditions of contest and details by mail upon receipt of assurances of entry.

The challenge followed the organization of the group as a trust estate under the name of "The American Eagle"—which has been adopted for the name of the airship when completed. Among the prominent engineers, aeronautical experts and scientists included in the group the following were mentioned yesterday by Secretary Cyril O. Assmus, in announcing the issuance of the challenges: Charles W. Burrows, Ph. D.; Charles H. Day, A. E. M.; Duval La Chapelle; Frederick Charavay, M. E.; I. S. Kaufman, B. S., C. E.; I. E. Glover, B. S.; J. H. Steenson; Joshua Ward, B. S., M. E., and Captain Hugo Sundstedt.

The latter has been named designing engineer of The American Eagle and his preliminary draft has received tacit acceptance. Captain Sundstedt's achievements in aeronautics have been international in scope. He left a naval career to take up aeronautics with Bleriot in 1909 and was later associated with Farman. During the war he was chief test pilot in the French Air Service. He holds honors for having made the first trans-Baltic Sea flight and Paris-Stockholm flight, among many others, and has been identified with American aeronautical activities since the close of the war.

Dr. Charles W. Burrows is a consulting engineer in New York with laboratories in Newark, N. J. He was formerly chief of the Magnetic section of the U. S. Bureau of Standards at Washington, in which post he served with professional distinction during the war, having been called to it from the department of physics at the University of Michigan. Dr. Burrows has accepted the post of Administrative Engineer and will pass on every detail of the construction and equipment of The American Eagle.

The board of consulting engineers



Airscape of the Stock Farm of Governor Warren McCray at Kentland, Indiana includes Charles H. Day, who, as chief engineer, designed the J-1 for the Standard Air Craft Corporation and built the American Handley-Page-Caproni bomber. He is engineer in charge of structure. Duval La Chapelle, who was with Orville Wright in France and is recognized as an authority on pontoons, which constitute his especial responsibility with the American Eagle. Frederick Charavay, M. E., among the foremost designers and experts on propellers is consulting engineer on this phase of the huge American plane.

F. A. Robertson, chief engineer of the Splitdorf Electric Company, and a recognized world authority on ignition, is in charge of electrical design and installation, and associated with the foregoing in charge of power plant, controls, material, instruments and aerodynamics, are engineers and experts whose names have not as yet been made public.

The partial personnel of the engineering staff given out by Mr. Assmus includes I. S. Kaufman, B. S., C. E., who has been active as a aeronautical engineer since 1910, and who served during 1918 and 1919 with the U. S. Army Engineering Corps, receiving a prize from the U. S. Government for designing a successful night bomber; I. E. Glover and James H. Steenson, who in addition to eleven years' experience in aeronautical engineering, devoted two years to exhibition flying and passenger piloting. Joshua Ward, B. S., M. E., was named as the Washington representative and Col. Evan Shelby as counsel.

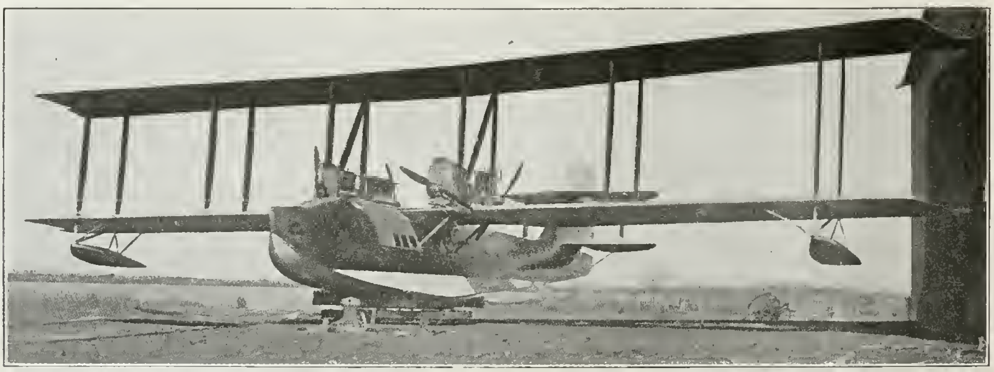
Despite the naval and military tinge to the personnel, the American Eagle project and the competition it has invited are described as approached purely in the spirit of sportsmanship on the premise that the contest will blaze the way for larger scale aerial commercial activities of an essentially peaceful nature and hasten the adoption of aerial cruisers for trans-oceanic passenger, mail and express business. This aspect is emphasized by the past activities of Secretary Cyril O. Assmus, through whom the announcement was issued, and who has organized and directed many cruises for the British Royal Mail Steam Packet, and the Hamburg-American companies prior to the war. The latter said of the project:

"This undertaking is simply and obvious development of the day—an elaboration of what has been done and is being done on a smaller scale. Experimental 'stunt' and 'gypsy' flyers have paved the way so thoroughly that a large number of American aeronautical experts came to the conclusion that only concerted action was necessary to circumnavigate the globe with an airship of practical commercial size to settle once, and for all time, the question of the scientific mastery of the air for other than destructive purposes.

"Work on The American Eagle has progressed in a quiet way over a considerable time. Reports of similar efforts abroad reached our ears and after deliberation it was agreed that the most manly and sportsmanlike method of approaching the subject was in laying our cards on the table for all the world and to invite international competition. This will go far to clarify the status of various prizes that have been offered from time to time for this feat, and doubtless will result in the offering of other prizes and trophies by the sportsmen of the world. It will also serve to stimulate a friendly constructive interest and enthusiasm among those who realize the airship will supplant the ocean liner for first cabin passenger, mail and express business, as distinguished from those who see in the aeroplane only an agency of war and destruction.

"We feel that we have no accasion to fear that American ingenuity and constructive genius in this field cannot hold its own against the world. In this connection the names that have become public do not tell the story of the personnel group in this project. Every inventor, engineer or manufacturer who has anything of value to offer, may contribute his idea or feature without sacrifice of proprietary rights. It will be tested for efficiency and if of superior value, will be used, making the American Eagle a great American aeronautical laboratory or clinic.

"Negotiations are pending with many prominent men and organizations for whom we have no authority to speak at this time because the negotiations have not reached the stage of completion. Now it's up to the world to try to beat America in this field."



The Pegna-Rossi-Bastianelli Seaplane. The machine, which is of nearly 100 feet span, is intended to carry a very large proportion of disposable load at the high cruising speed of 100 m.p.h. It is equipped with four Isotta-Fraschini motors of 270 H.P. each, arranged two in tandem in each of the two wing nacelles.

The Berliner Helicopter

HAVING perfected a helicopter which will rise gracefully from the ground and glide forward with the same precision as the most advanced type of aeroplane, Henry A. Berliner, a Washington inventor, is now busily engaged in further perfecting his vertical-rising airship so that it will alight with a degree of safety that will make it available for peace or war-time purpose.

The Berliner helicopter has undergone a series of tests at the flying field at College Park, Md., a suburb of Washington, before high aviation officers of the American Army and Navy and military attachés of foreign governments stationed here. All have pronounced the machine a success. In all the tests Berliner, the young inventor, has piloted the helicopter, which is capable of rising vertically from a standstill to a height of twenty feet and then advancing in a forward direction around the field without loss of distance from the ground. The machine, it is said, responded perfectly to Berliner's demands while in flight, but the inventor has not yet perfected the machine to the extent of landing from any height with the degree of safety that is required.

"We have demonstrated that our machine can rise vertically from the ground and we have further shown that it can move forward and is capable of control in flight," Mr. Berliner said today, "but the problem of landing safely is yet to be solved. Once this is solved I believe the helicopter will become as practical as the present-day aeroplanes, with the added feature of taking off in small areas and possibly landing in the same restricted zone."

Bringing New Machine to Earth Is Problem

Mr. Berliner would not discuss the possibility of entering his invention in the competition for the $250,000 prize offered by private British interests for the perfected helicopter. He said, however, that if he perfects his machine so that it will land with safety the future of the helicopter is assured.

Bringing the machine to earth safely, therefore, is the big problem that Berliner has set out to solve. The machine as now designed comes down with a rock-like fall when the motor is cut off. With an engine of extreme nicety of adjustment and absolute certainty of action descent might be made by simply throttling down the propeller speed gradually. As there is no engine of such dependability, other means must be found by Berliner.

The use of parachutes or any balloon-like aid would add too much weight to the machine. Another method proposed is that in coming down the propellers be so built that they can be disconnected from the engine and the angle of the blades changed so that they will offer greater resistance.

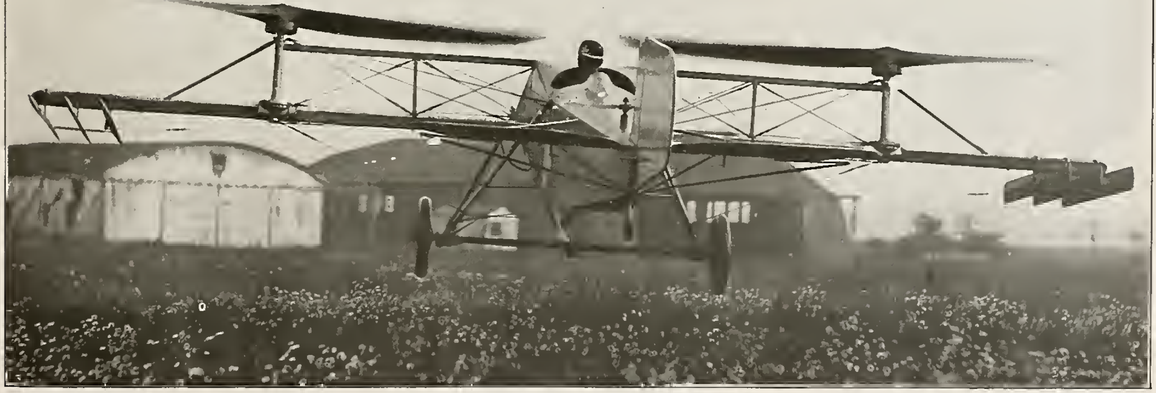
The Berliner machine resembles an aeroplane without wings. The fuselage and rudder are the same, and a Lerhone 110-horsepower rotary motor is mounted forward as in an aeroplane. On either side of the fuselage there is an upright carrying a 14-foot propeller. These two propellers revolve in opposite directions and force the air downward, lifting the 1,400-pound machine and pilot off the ground.

Near the tail there is a small propeller, which is geared also to the motor and which tilts the entire helicopter by slightly lifting its tail. This tilt causes the forward motion of the machine. The inventor claims that with a 1,000-pound load but 3 per cent of the lift is lost in a tilt of 15 degrees, and that this loss is transferred into horizontal push of about 25 per cent of lifting power. This is a somewhat greater tilt than has been used in most of the experiments, but he thinks that a 25-degree tilt may possibly be reached safely.

Idea Follows Plan Worked on by Father

In evolving the helicopter Berliner has been preceded by his father, Emile Berliner, an inventor, who took up the old idea of constructing a machine that could rise vertically from a standstill about twelve years ago. Since then he had been experimenting, building and rebuilding it, until he was forced to give up the task about three years ago on account of illness. Henry, who is twenty-six years old and was graduated from the Massachusetts Institute of Technology, then took up the work and succeeded in making the first flight in a machine of that type.

The success of the machine is due, in part, the inventor said today, to the size of the two propellers that are placed on the machine in a position that would correspond to the outer wings of a biplane. Many have tried to use mammoth propellers, some as long as fifty feet, he said, but they derived no results.



The Berliner Helicopter in Flight

Once in the air, the helicopter moves forward with the aid of a three-foot propeller attached to the tail of the machine, which tilts it downward.

The body or fuselage, which is about twenty feet long, was taken from an aeroplane, and likewise the rudder, which guides the machine from left to right. Both father and son believe the machine has wonderful potentialities. They point out that this type of aeroplane would be especially advantageous to the Navy, as the seaplanes and flying moats now in use require a long stretch of water as a "take-off."

The helicopter, or vertical-rising air machine, is not an impossibility, and should a real use for such type arise successful ones may be seen before many years, according to Dr. Albert F. Zahm, aeronautical expert for the Navy, in an interview with the Associated Press. Had there been a need for the helicopter during the war, he said, any of several types could have been perfected, of which working models have been flown.

Dr. Zahm is an expert on design and construction of all manner of flying machines. For years he has applied his time to perfection of the aeroplane, and is well qualified to pass upon the capabilities of any.

Much interest has been shown of late in reports of successful machines of the helicopter type being perfected in both Germany and England. However, while some flights have been made, none of any consequence are reportd by a machine equipped with horizontal propellers or revolving planes, designed to rise vertically from a confined space and descend on the same.

That the helicopter is possible, Dr. Zahm said, is proved by the German machine, which, rising several times to moderate heights, has carried observers, remained almost stationary while in air and descended in safety. The machine, however, has made no extended flight, such as would prove its dependability, but was tethered to the ground by a mooring rope. At times, when the motors failed, the machine dropped and the passengers saved themselves only by leaping with parachutes.

The experiments are continuing, however, with the purpose of perfecting a motor which can be depended upon to maintain the machine without sudden failure, the scientist explained, for as soon as the engine stops the machine cannot glide to the ground, as does an aeroplane, but drops vertically. In a proper descent the propellers should be whirled slowly to ease the landing.

Present hopes of attaining successful vertical flight rest mainly upon the endeavors of Mr. Berliner and of Louis Brennan, of London, whose newest machine is reported as nearing completion. He is working to win the £50,000 prize offered by the British Air Ministry for successful flight.

The helicopters upon which most experimentation has been made consist mainly of two or more propeller screws mounted horizontally on a vertical shaft, bearing engines, fuel and passengers. Equal numbers of propeller blades must revolve in opposite directions that the body of the machine may not spin like a top. The motors, tanks and body have been mounted in various positions, but the German machine has a sort of pulpit car mounted at the top of the shaft over the propellers for the operators.

Other Types of Vertical Flying Machines Offered

Whether or not this type of machine is brought to actual use, Dr. Zahm stated, at least two other types of planes that may fly vertically have been offered to the Government. This fact is not widely known.

One of these, of which Dr. Zahm observed experiments with a working model, was almost identical with the present type of plane, except that mounted behind the body were two sets of air vanes, in groups, tilted at an adjustable angle, like that of Venetian blinds.

When the power was turned on, he said, the "wash" of the air stream from the propellers pushing against these groups of vanes caused the model to rise gently vertically. The model was held in midair by the action, and when the power diminished it returned gently to earth. A full-size machine of the type, he said, would be equipped with engines of immense power in order to furnish sufficient air pressure, and when driven to a sufficient altitude the vanes would be so adjusted that horizontal motion would result. The plane could then fly in the usual manner, finally using the vanes again to descend vertically.

The other type offered to the Army, he said, was of the present wing plan, equipped with three propellers, two placed far out toward the wing ends and with vertical rudders and ailerons similar to those in use. The quicker lifting power was to be gained by having the wash of the central propeller act upon elevators on the tail of the body, while the side propellers would wash against the special ailerons on the wing tips.

When in the air, Dr. Zahm continued, this machine could maneuver exactly as does the ordinary plane, cut figures and do "stunts," besides being able to rest motionless in any desired position—vertical, with nose up, if need be.

The best feature, he said, is that both planes of the new types are entirely feasible and can be constructed at any time. In fact, several European inventors and manufacturers are patenting designs of the second type, notably the Frenchman Bleriot, one of the pioneers of aviation.

Cost and Weight Called Drawbacks to Construction

Experts for the Government studied the second type during the war, it was explained, but the matter went no further.

The general drawbacks of their construction, Dr. Zahm said, were, first, the great cost; second, the increased weight of the machines as compared with present engine efficiency; and, third, the need of developing motors with greater power and less weight per horsepower and with a greater amount of dependability. As it is, he said, a successful helicopter may be flown to any height, but the operators will never know when the engine will give a cough and die away.

The German experimenters, however, he added, have in part overbalanced this disadvantage. It has been determined by experiment that a propeller of three or four narrow blades, caused to revolve by the air pressure resulting from a forced descent with a dead engine, will develop as much parachute resistance as a solid disc of the diameter of the blade spread. In addition, the German machine is equipped with air cushions on the landing bottom so that the landing, if forced, may be made comparatively easy.

Means of steering experimental helicopters, and of which one would undoubtedly be used in a successful machine, are two. The first is a means of tilting the propeller's shaft or the whole machine, when it will travel in that direction; the second being the use of vanes similar to those already described. With the latter, Dr. Zahm thinks, a helicopter sufficiently powered should be able to cut capers in the air as aviators do at present.

Any of the types advanced would, in warfare, be of great use in bomb dropping or for observation. The main disadvantage, that of being a good target for artillery fire while stationary, could be offset by quickness of movement from point to point and short stops while hovering.

Detroit's Aerial Contests

THE Aviation Country Club of Detroit announces the sixth annual contest for the Curtiss Marine Flying trophy, first annual contest for the Detroit News Aerial Mail trophy, first annual contest for the Aviation Country Club of Detroit trophy, first annual contest for the Liberty Engine Builders' trophy, and the third annual contest for the Pulitzer trophy. This aviation meet was primarily scheduled for the purpose of holding the third annual Pulitzer Race. However, in order to arouse the widest possible interest in flying and stimulate the development of commercial aviation, the plans have been elaborated to include diversified types of planes. The intention is to attract a varied field of land and water entries to compete for prizes to be awarded on the basis of the best combination of high speed and improved construction without, however, having recourse to complicated rules incapable of being satisfactorily applied.

Event No. 1

The Detroit Aerial Water Derby, including Curtiss Marine Flying Trophy, Monday, September 4th. Cash Prizes: First prize, $1,200; second prize, $600; third prize, $200.

1. The trophy shall be perpetual and competed for annually by seaplanes and flying boats.
2. The contest shall be in the nature of a race either around a closed circuit or from point to point The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.
3. The trophy shall be awarded each year to the aero club represented by the pilot of the winning machine, and this club shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Curtiss Marine Trophy, or of assigning this privilege, under sanction, to any other club or organization.

The Curtiss Marine Trophy

1. CONDITIONS OF CONTEST:

(*a*) Factor of safety—Monoplanes, 6 as loaded for start of race; biplanes, 4 as loaded for start of race.

(*b*) Air speed greater than 70 miles per hour, as loaded for start of race.

(*c*) Visibility and maneuverability (water and air) which in opinion of Contest Committee, Detroit Aviation Society, is not a menace to other contestants or spectators.

2. DISTANCE:

Approximately 160 miles — eight times around a closed course of 20 miles.

3. (*a*) START:

The starting signal will be given at 3 p. m. Planes to be in their allotted places at 2 p. m. Pilots' meeting for the final instructions to be announced later.

(*b*) POSITION AT START:

Planes competing for class and invitation prizes in addition to Curtiss Marine Trophy will be sent away together in a class, the faster classes starting before slower. Competitors for Curtiss Marine Trophy only will be sent away together after the classes.

(*c*) METHOD OF START:

Contestants will be lined up along the shore in shallow water for the start. The starter will assign an assistant starter to each plane who shall raise the signal flags for its pilot, as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 2:45 p. m. When the motor on each plane is running, the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 3 p. m., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds; each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red starting flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be started after a delay of two hours.

4. THE FINISH:

The finishing time will be taken when each plane flies across the finishing line between the marks defining this line, after having completed the full course, 160 miles.

5. THE WINNER:

Of each first place shall be the pilot which has completed the full course in the shortest elapsed time, and of each second place the second best time, etc., provided the pilot is not disqualified. The Curtiss Marine Trophy will be awarded to the club represented by the pilot and the prize money paid to the entrant of the winning seaplane or flying boat. Agreements between pilots and entrants as to their proportional share of the prize money will be upheld by the Contest Committee, who will pay the prize money in accordance with agreements in writing between pilots and entrants, presented to the Contest Committee prior to the race or within 24 hours after the finish of the race.

6. QUALIFICATIONS:

No seaplane or flying boat may take part in the contest unless it is piloted or commanded by a pilot, who must be on board and who must be furnished with a license issued by the Contest Committee of the Aero Club of America. (F. A. I. Rules, Art. 67.) Every person furnished with pilot's certificate of F. A. I. may obtain license issued optionally by Contest Committee, Aero Club of America. (F. A. I. Rules, Art. 70.) A license will be valid until December 31st of the current year. The Contest Committee, Aero Club of America, may, upon the occasion of any competition or test, issue temporary license as pilot for this one test only to any person whose qualifications it considers sufficient. (F. A. I. Rules, Art. A-28.)

7. DISQUALIFICATIONS:

Any contestant breaking the above rules of the race, or subsequent ones which may be sent out in writing, shall, upon recommendation of the judges, be disqualified.

"Every person organizing or taking part in a sporting event of whatsoever nature is supposed: (1) "To know the present regulations (F. A. I. Rules) thoroughly." (2) "To agree to submit without restriction to the consequences that result therefrom." (F. A. I. Rules, Art. 7.)

8. RULES OF THE RACE:

(*a*) Upon receiving the getaway signal for the start, pilots shall hold a straight course and not cross or attempt to cross in front of the planes on either side.

(*b*) From a standing start contestants will fly around the first four laps of the course, and during laps five, six and seven will be obliged to alight on the water and while running along the surface of the

The Pulitzer Trophy

water enter into and pass through, in the proper direction, the water controls which shall be designated by moored markers on both sides.

Note: (There will be only one water control in the shape of a hairpin turn.) The entrance into and exit from this control will be located sufficiently near the turning mark that anything but normal landing speeds or normal taxing speeds will overrun the turning mark and result in loss of time.

(*c*) While within the markers bounding the water controls, the contestants must maintain constant contact between the water and fixed surfaces of the principal flotation gear (wing or tail pontoons, or water rudder, or any other adjustable, movable or flexible attachment is not sufficient contact with the water under this rule).

(*d*) A plane overtaken, both planes being in the air, must hold its altitude and a true course, in order that it may not in any way impede or interfere with the faster overtaking plane.

(*e*) A plane overtaking a slower plane, both planes being in the air, shall never pass or attempt to pass between that plane and any pylon or object used to mark a turning point.

(*f*) Within the water controls, both planes being on the water, the overtaking plane must pass to the right, and all mechanicians of competing planes must look to the rear and warn pilots of an overtaking plane. Pilots of overtaken planes must keep to the left and result in loss of time.

(*g*) The finishing line must be crossed in flight—not on the water—and, after crossing the finishing line, all planes shall continue on their course until they have attained sufficient altitude to enable them to turn and land without crossing the course or finishing line.

(*h*) No contestant shall start before he receives the getaway signal.

(*i*) Pilots shall pass outside all turning points and in plain view of officials stationed at each point, and at an altitude of not more than 250 feet.

Fouling a Mark. "Any contestant who has failed to turn a stake properly may validly continue on the circuit provided he makes a complete turn of the said stake and then continues his trip in the same direction." (F. A. I. Rules, Art. 115.)

(*j*) No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

9. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of Detroit Aviation Society within twenty-four hours after the finish of the race. (F. A. I. Rules, 78, 79, 80.) (Appeals. See F. A. I. Rules, Art 178-179.)

10. NUMBERS:

Each plane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering over twelve inches in height.

11. ADVERTISEMENTS:

"Competitors are forbidden to display on their apparatus or material any commercial advertisement except the trade-mark of the constructor of the apparatus." (F. A. I. Rules, Art. 89.)

Note: (The word plane as used in these rules means flying boats or seaplanes.)

ADDITIONAL PRIZES:

The (to be announced later) prizes for greatest air speed will be awarded to the contestant who, during the Curtiss Marine Trophy race, completes laps 2, 3 and 4 in the shortest total elapsed time.

The first lap is not included because of the standing start.)

Additional prizes will be awarded for class or invitation races to be announced by the Contest Committee of the Detroit Aviation Society after entries have closed.

(*a*) CLASS RACES:

Four or more planes of the same design and equipped with the same motor shall constitute a class.

CLASS RULE:

Planes eligible for class races are those constructed under the same design and general specifications and not altered to materially change these specifications, nor to prevent the interchange of any corresponding part or parts of any two planes.

Furthermore, should any interchange of corresponding part or parts be directed under this rule, the plane must remain the same after the interchange from the standpoint of design and operation.

EXCEPTIONS:

Stream-lining which does not alter the structure of the part or parts stream-lined.

Motors eligible for class races are determined by the above rule and these exceptions.

1. Stream-lining which does not alter the structure of the part or parts stream-lined.

2. Motors may be equipped with any make or design of propeller, ignition, spark plugs, carburetor, including intake manifold, exhaust manifold, gasoline and oil systems.

(*b*) INVITATION RACES:

The Contest Committee of the Detroit Aviation Society may invite any of the entrants to compete for a special prize.

Event No. 2

Detroit News Aerial Mail Trophy, Thursday, September 14. Cash prizes: First prize, $1,200; second prize, $600; third prize, $200. Race for large-capacity, multi-motored aeroplanes.

1. CONDITIONS OF CONTEST:

(*a*) Factor of safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(*b*) Air speed greater than 75 miles per hour.

(*c*) Carrying contracted, specified or advertised loads.

2. DISTANCE:

Approximately 264 miles—four times around a closed course of approximately 66 miles, starting at Selfridge Field, passing over captive balloon located approximately 18 miles away, at approximately 5,000 feet altitude, thence to Aviation Country Club's Field, thence to Packard Field, and then returning to Selfridge Field.

3. (*a*) START:

Starting signal will be given at 11 a. m. Aeroplanes to be on their allotted places on the Field at 10 a. m. Pilots' meeting for final instructions will be announced later.

(*b*) POSITION AT START:

Planes competing for the Detroit News Aerial Mail Trophy will be sent away together in a flight, or series of flights, dependent on the number of entrants and conditions at time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Sept. 9th, 1922.

(*c*) METHOD OF START:

The starter will assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot, as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 10:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 11 a. m., the starter will raise, in addition to the red starting flag; the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks defining this line, after having completed the full course, approximately 264 miles.

5. WINNER:

The winner of the first place shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's License issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(*a*) Pilots must hold a straight course after starting until they have gone the distance to be specified and marked.

(*b*) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(*c*) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(*d*) Pilots must attain the altitude of the captive balloon each lap, and in passing shall do so to either side in order that the observers in the basket may clearly see the aeroplane's number. Any pilot not having sufficient altitude upon reaching the balloon shall continue to climb, but must make a circle so that when passing the balloon the second time the aeroplane will be headed in the line of flight of the course.

(*e*) All pylons marking turning points must be passed at an altitude not greater than 400 feet.

(*f*) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the field, and land in that part of the field assigned for landing and in so doing shall not cross the course or finish line.

(*g*) Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society within twenty-four hours after the finish of the race.

9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of the lower wing on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

Event No. 3

Aviation Country Club of Detroit Trophy, Thursday, September 14. Cash prizes: First prize, $1,200; second prize, $600; third prize, $200. Race for light commercial aeroplanes.

1. CONDITIONS OF CONTEST:

(*a*) Factor of safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(*b*) Air speed greater than 80 miles per hour.

(*c*) Arranged to seat three or more passengers, including pilot, and carrying their capacity load; 160 lbs. of ballast must be carried in place of each passenger omitted.

2. DISTANCE:

Approximately 264 miles—four times around a closed course of approximately 66 miles, starting at Selfridge Field, passing over captive balloon located approximately 18 miles away at approximately 5,000 feet altitude, thence to Aviation Country Club's Field, thence to Packard Field, and then returning to Selfridge Field.

3. (*a*) START:

Starting signal will be given at 12:00 noon. Aeroplanes to be on their allotted place on the Feld at 11:30 a. m. Pilots' meeting for final instructions will be announced later.

(*b*) POSITION AT START:

Planes competing for the Aviation Country Club of Detroit Trophy will be sent away together in a flight, or series of flights, dependent upon the number of entrants and the conditions at the time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Sept. 9th, 1922.

(*c*) METHOD OF START:

The starter will assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 11:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 12:00 noon, the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5:30 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks defining this line, after having completed the full course, approximately 264 miles.

5. WINNER:

The winner of the first place in the race proper shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's license issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(*a*) Pilots must hold a straight course after starting until they have gone the distance to be specified and marked.

(*b*) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(*c*) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(*d*) Pilots must attain the altitude of the captive ballon each lap, and in passing shall do so to either side in order that the observers in the basket may clearly see the aeroplane's number. Any pilot not having sufficient altitude upon reaching the balloon shall continue to climb, but must make a circle so that when passing the balloon the second time the aeroplane will be headed in the line of flight of the course.

(*e*) All pylons marking turning points must be passed at an altitude not greater than 500 feet.

(*f*) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the Field, and land in that part of the Field assigned for landing and in so doing shall not cross the course or finish line.

(*g*) Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society, Inc., within twenty-four hours after the finish of the race.

9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing on each side of the fuselage, clear of the wing in characters as large as possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

11. CONDITIONS OF TRIALS:

Trials for operation of self-starter and muffler for planes thus equipped—also the examination for bonuses given for complete accessibility to: Oil, water, gas-filling caps, draining plugs and filtering screens, ignition breakers and distributors, and carburetor adjustments and inspection—will be conducted from August 31st to September 13th, 1922.

12. Any contestant failing to make these trials during this period shall, at the discretion of the Contest Committee, forfeit the rights to the points which he may have gained—even though the trials are made after the race.

13. This trophy and cash prizes are to be awarded on points, given as follows:

(*a*) To the winner of the race proper—600 points. To those finishing within twenty minutes of the winner their pro rata share of points on the basis of a loss of 30 points per minute late.

(*b*) A bonus of 100 points will be given to each aeroplane carrying an operative self-starter.

(*c*) A bonus of 100 points will be given to each aeroplane carrying a muffler which effectively muffles the motor at a height of 1,500 feet, in normal flight.

(*d*) A bonus of 50 points will be given to each aeroplane having complete accessibility to the following: Oil, water, gas-filling caps and drain plugs.

(*e*) A bonus of 100 points will be given to each aeroplane having complete accessibility to the following: Spark plugs, oil and gasoline screens, ignition breakers and distributors, and carburetors in respect to both adjustment and inspection.

In the event of a tie in the scores of two aeroplanes, the aeroplane having received the greatest number of points in the race shall receive an extra point.

Event No. 4

Liberty Engine Builders' Trophy, Friday, September 15. Cash prizes: First prize, $1,200; second prize, $600; third prize, $200. Race for observation type (2-passenger) aeroplanes.

1. CONDITIONS OF CONTEST:

(*a*) Factor for safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(*b*) Air speed greater than 90 miles per hour.

(*c*) Carrying U. S. Government specified load for this type of aeroplane.

2. DISTANCE:

Approximately 240 miles—six times around a closed course of approximately 40 miles, starting at Selfridge Field, thence west to captive balloon, thence to Packard Field and returning to Selfridge Field.

3. (*a*) START:

Starting signal will be given at 11:00 a. m. Aeroplanes to be on their allotted places on the Field at 10 a. m. Pilots' meeting for final instructions will be announced later.

(*b*) POSITION AT START:

Planes competing for the Liberty Engine Builders' Trophy will be sent away together in a flight, or series of flights, dependent upon the number of entrants and the conditions at the time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Sept. 9th, 1922.

(*c*) METHOD OF START:

The starter shall assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot at follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 10:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 11:00 a. m., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the bricks from under the wheels. Each

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Annual Meeting of the Aeronautical Chamber of Commerce

THE annual meeting of the Aeronautical Chamber of Commerce of America, Inc., was held at the executive offices, 501 Fifth Avenue, New York City, July 11. The organization, which was formed the first of the year, with a charter membership of one hundred, reports an increase of nearly 100 per cent in six months. Preparations for flying meets in Chicago in August and Detroit in October were announced.

The following Governors were unanimously re-elected: Grover C. Loening, Loening Aeronautical Engineering Corp.; Charles F. Redden, Aeronautical Airways, Inc.; C. C. Witmer, Airship Manufacturing Co., of America; B. E. Bushnell, Stewart Hartshorn Co.; S. S. Bradley, Manufacturers Aircraft Association, Inc.; Charles H. Colvin, Pioneer Instrument Co.; S. M. Fairchild, Fairchild Aerial Camera Corp.; John M. Larsen, J. L. Aircraft Corp.; Lawrence Sperry, Lawrence Sperry Aircraft Corp.; Frank H. Russell, Curtiss Aeroplane & Motor Corp.; F. B. Rentschler, Wright Aeronautical Corp.

General Manager's Report

Following is the annual report made to the members of the Aeronautical Chamber of Commerce by the General Manager, S. S. Bradley.

Membership

Our organization was formally announced Jan. 1, last, with 100 charter members. In the first six months we have increased our membership to 176, divided as follows: Class A—19; Class B—39; Class C—117. Since the last meeting of the Board of Governors, 7 Class B and 13 Class C members have been added. In addition, full and complete co-operation has been obtained with two important groups in the lighter-than-air field. Among the new members are the following:

Electric Storage Battery Co., Philadelphia, Pa.

Endicott Forging & Mfg. Co., Endicott, N. Y.

Hamilton Aero Mfg. Co., Milwaukee, Wis.

Macwhyte Co., Kenosha, Wis.

Radio Corp. of America, New York.

Standard Oil Co. (Indiana), Chicago, Ill.

Tide Water Oil Sales Corp., New York.

Flying Meets

We have co-operated in holding two flying meets this spring; the first at Garden City on April 30, and the second at Baltimore on May 30. The attendance at the Garden City Meet was conservatively estimated at 20,000; the one at Baltimore, 5,000.

In addition to the above, we have an agreement with the Detroit Aviation Society contemplating our assistance in the management of the races at the flying meet to be given in Detroit next October.

General Contact

Washington: Close liaison has been maintained with official Washington. Representatives of the Chamber held a conference with President Harding on April 13, 1922, at which time the need of aerial law and an aggressive aerial policy was urged. Following this conference the President wrote a most important letter indicating the continuation and extent of his interest in the subject of aviation and our organization. A copy of his letter is attached hereto.

War and Navy Departments: Our contact with the Air Services has followed lines with which our members are familiar, and recently has been particularly active due to the participation of the Departments in the races at Detroit next fall.

For some time we have emphasized upon the War Department the necessity of great care in the release and sale of surplus material. In the past sales of surplus aeronautical material have resulted in a number of fatal accidents, due to the failure of machines in flight. We are therefore gratified to report that such a policy has now been adopted by the Department and that every precaution is being taken, in the absence of air law, to prevent unairworthy material being sold to the public.

We have consistently and persistently advocated recognition on the part of the public and the Government that we must have an aircraft industry before we can have aviation. We have recently seen many evidences of increased acceptance and appreciation of this fact.

During the month of May we completed and submitted to the War Department an extensive aeronautical industrial survey. This survey was based upon a questionnaire originating with the Secretary of War, which we addressed to our members. We have received various acknowledgments from officers in the Air Service and the Office of Secretary of War, advising us that the information thus gathered is greatly appreciated by the Department.

Post Office Department: On January 6, February 21, April 28 and 29, hearings were held by the House Committee on the Post Office and Post Roads on bills introduced by Representatives Steenerson and Kelly proposing authority for air mail contracts. At the request of the Post Office Committee, we sent out a questionnaire to our members and to 100 Chambers of Commerce throughout the United States. A digest of the replies was prepared and submitted by us at the hearings. All of which has been printed in the official report and distributed to our members. Through contact with the office of the Air Mail Division, we have advocated and encouraged the plan to develop night flying of the Air Mail.

Department of Commerce: We have prepared and submitted to the Secretary of Commerce a summary and report of commercial aviation in the United States during the past year. This was submitted to the Secretary of Commerce on April 10, and after being studied by the Department the report was released by Secretary Hoover to the newspapers on June 20. This report also provided material for distribution to Congressional Committees. It has also been very generally helpful as forming the basis for a very large number of constructive editorials in the newspapers throughout the country.

Aerial Legislation

Our work in connection with the Wadsworth Bill, S.3076, has been continuous. In addition to our interview with President Harding, we subsequently had conferences with the Assistant Secretary of Commerce, Mr. Huston; Chairman Winslow of the House Committee on Interstate and Foreign Commerce; Dr. Klein, the head of the Department of Foreign and Domestic Commerce; and Judge Lamb, Solicitor of the Department of Commerce. At Judge Lamb's request we called, at very short notice, a conference of our members at our offices in New York. At this time the entire subject was discussed in detail and it was planned that following this conference final recommendations from the Department of Commerce were to be prepared and submitted to Congress. The advancement of the bill is now delayed on account of a suggestion that has been made to give consideration at this time to the question of the desirability of consolidating all aeronautical activities of the Government in a single department. This is regarded as very unfortunate as it will delay final consideration very greatly.

Trade Association Conferences

On April 13 we participated in the National Trade Association Conferences with Secretary Hoover. A representative of our office was appointed to serve with the National Automobile Chamber of Commerce and the Motor and Accessory Manufacturers' Association, to prepare a foreign trade booklet, to be distributed by the Department of Commerce throughout the world. Copies of this pamphlet have been sent to our members.

On May 16 to 18 we attended meetings of the Chamber of Commerce of the United States. As members of this body, our activities fall within the Department of Transportation and Communication. The manager of this department, J. R. Bibbins, is assisting us in establishing contact with the various local Chambers of Commerce throughout the United States for the purpose of enabling us more effectively to extend our educational work.

We are finding increasing opportunities to extend our work and establish close contact with local commercial organizations throughout the country. Due to the interest aroused by us in the Air Mail hearings, the Merchants' Association of New York City sent a representative to attend the hearings in Washington. Following this, which coincided with a request for data from the Chief of the Air Service, the Merchants' Association decided to appoint an Aeronautical Committee. We had the privilege of conferring with them relative to the personnel of this group. As a result, a member of our organization has been requested by Lewis E. Pierson (president of the Irving National Bank), president of the Merchants' Association, to act as a member of this committee, with a number of very prominent and influential business men whom they have selected for this service.

We have maintained very close relations with the Chambers of Commerce of Boston and Philadelphia. At Philadelphia a representative of our office addressed the representatives of their organization and obtained places on the Aviation Committee for two of our members who are in business in Philadelphia. In Boston we have co-operated with the Chamber of Commerce in their successful effort to secure through the State Legislature an appropriation providing for the establishment of a municipal airport in that city. A letter from this organization, thanking us for our support and co-operation, expresses the conviction that our activity had a very great deal to do with the successful outcome of this movement. We have participated in similar propositions with Chambers of Commerce of Baltimore, with the Aero Club of Illinois, the Chicago Association of Commerce, and other organizations in Burlington, Vt.; Brunswick, Me.; Kansas City, Mo., and Hartford, Conn. A representative of the Chamber addressed the Aero Club of Hartford on this subject of municipal landing fields a few weeks ago.

Except for those members who are in frequent contact with our office, there is probably very insufficient appreciation of the extent to which our offices are used as a meeting place for the exchange of ideas and discussion of general questions affecting the art and industry. There is a constant flow of visitors, the facilities of the library are in constant and increasing demand, questions affecting individual members and the industry as a whole are submitted to us for consideration and advice, with the result that the organization acts as a stabilizing and at the same time stimulating agency, with a constant tendency toward straight thinking and harmonious co-operation throughout the entire field. While this places a great tax upon the personnel of the office, making it at times very difficult to handle the correspondence and other details of routine, we feel that it is very essential that this work be maintained. One tangible result of this sort of contact that must be apparent is in the quality of the publicity that we are getting. Without the advantages of a clearing house, such as our offices afford, there would be a vast amount of misinformation released and printed. The amount of this sort of material, based upon rumor or suspicion, or hope or expectation, that is arrested and diverted each week is very considerable.

Publicity

Our activities in this field have been carried on along the lines with which members are all familiar. In some respects the work has been expanded. On our initiative arrangements were made for the broadcasting of aeronautical information from the great radio station on Staten Island. This was made possible through the courtesy of the Radio Editor of the New York *Tribune*, Jack Binns. Within the last few weeks we have supplied thirty magazine writers with material and photographs for aeronautical stories. Motion pictures of aeronautical events, which we have either arranged directly or have assisted, are running each week. Aeronautical photographs have been given to the news photo agencies two or three times a week, and at frequent intervals stories of current aeronautical interest are supplied to the Associated Press, the International News, the United Press and all foreign news syndicates with headquarters in New York.

We frequently learn, some time after the event, that various members have participated or had knowledge of important aeronautical news stories, where the opportunity has been missed of utilizing our facilities in securing proper publicity, due to failure to notify us of the event at the time. The members are particularly requested, whenever practicable, to report to this office promptly any event in aviation that appeals to them as being desirable publicity. We cannot promise that each story reported will be featured, but you may be certain that, to the best of our ability and judgment, the matter will receive prompt attention.

Year Book

The Year Book is now ready for distribution. Members are requested to order Year Books promptly if they have not already done so. This year's edition will be particularly valuable due to the Engine Division in the Design Section. This consists of 18 full pages of line drawings of historical and contemporary engines.

Bulletin Service

Every effort is being made by the Chamber to eliminate waste motion, to establish economies and yet maintain our service. The sales, library, Congressional and other memoranda you are familiar with. To meet a real demand, especially from the Class C members, and also to provide a medium for the dissemination of data of general interest to all members, a new series of bulletins has been established to be known as "Information." This bulletin, the first of which was issued in June, will be produced the first of each month and sent to the entire membership. This is also used for publicity purposes.

New Projects

Detroit Races: We have an agreement with the Detroit Aviation Society to co-operate with them in the management of the races at the time of the contest for the Pulitzer Trophy in October of this year. A representative of our office will attend to the details of management of the races beginning July 20 and ending October 20, and this office will, either from New York or Detroit, handle and direct all publicity.

Chicago Meet: Through the incorporation, a few weeks ago, of the Chicago Aeronautical Bureau, the situation in Chicago crystallized into

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The 18-Ton Parseval Semi-Rigid Airship "PL27"

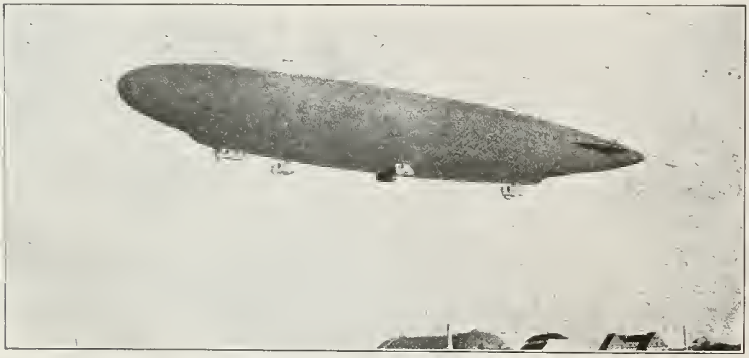
Although built as long ago as 1916, there are several reasons why the Parseval type "PL27," designed and built by the Luftfahrzeug-Gesellschaft of Bitterfeld, is of sufficient interest to merit a fairly detailed description at the present time. In the first place, the airship was one of the largest semi-rigids ever built, being only very slightly smaller than the ill-fated "Roma," purchased by America from Italy some time ago. Secondly, her design was one representing a considerable departure from previous German non-rigid practice, approaching, in fact, more to the Italian than to previous German types. In spite of the accident to the "Roma," this type of airship is thought by many to have a very considerable future before it, and it is open to discussion whether the world, led by Germany, was right in deciding in favor of the rigid type of ship. In Germany at the present time, there is a strong opinion that the limits in non-rigid and semi-rigid airships have in no way been reached, and certainly one could enumerate several advantages which these types possess as against the rigid. One very important item is that of cost, and in this respect the non-rigid, and, to a somewhat smaller extent perhaps, the semi-rigid compares very favorably indeed with the rigid. The very expensive Duralumin framework is avoided, which at once means a great saving. Col. Cave-Browne-Cave, one of our soundest, and certainly our most persistent and eloquent advocate of the non-rigid airship, stated in one of his admirable lectures before the Royal Aeronautical Society that, according to his calculations, six non-rigids, each of 500,000 cubic feet capacity, could be built for the price of one rigid of 2,000,000 cubic feet capacity. In other words, with the non-rigid, we should get an extra million cubic feet capacity for the same money.

Then there is the question of useful load. Here again Col. Cave-Browne-Cave indicated that a greater percentage of useful lift is obtained in the non-rigid than in the rigid, owing chiefly to the absence of the hull structure. Thus the point where the structure weight is no more than 50 per cent of the total lift is reached in the non-rigid with the half-million cubic feet ship, whereas in the rigid it is not attained until one comes to sizes of about two million cubic feet. It would, therefore, appear that we may have been on the wrong track in pinning our faith almost exclusively to the rigid type. With things as they are at present, the question of the purchase, running and upkeep of a rigid is a big item. It is, at least, open to doubt whether we should not be better advised in making a start on airship services with types other than the rigid. As regards safety, there is probably little to choose between the types, and the non-rigid, apart from the advantages already outlined, has another in that, when not in use, it can be deflated and stored away in the corner of a shed. A rigid airship occupies as much space when deflated as it does when inflated. Furthermore, in the case of a forced landing, the non-rigid, and the semi-rigid which has its keel built in sections, can be packed up and sent home. The rigid, if it should be forced down from any cause, would almost certainly have to be written off as a total loss.

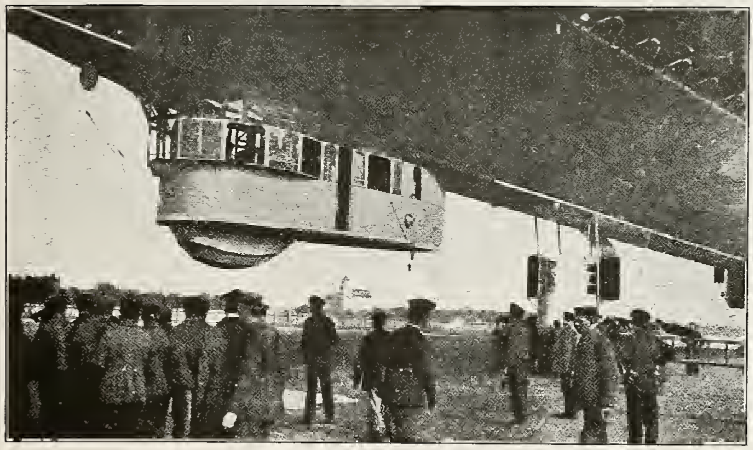
There is a great deal more which could be said about non-rigid and semi-rigid airships in general, but sufficient has, we think, been said to indicate that, as it has now been proved that these types need not be restricted to small airships, this class of airship deserves more consideration, from a commercial aviation point of view, than it has received in the past.

The Parseval "PL27" has an overall length of 157 meters (515 ft.), a maximum diameter of 19.6 meters (64 ft. 4 ins.), a greatest circumference of 61.55 meters (202 ft.) and a height of 26.5 meters (87 ft.). Its cubic capacity is 31,300 cubic meters (1,104,000 cubic ft.) and the disposable lift is approximately 18,000 kilograms (nearly 18 tons). Assuming a lift of 65 lbs. 1,000 cubic ft. of hydrogen, the total lift would be approximately 32 tons, so that the disposable lift is 56 per cent of the gross lift, which is considerably better than the figure of 50 per cent given by Col. Cave-Browne-Cave for a 500,000 cubic ft. ship. The allocation of this 18 tons of lift would, of course, depend upon the purpose for which the airship was intended. For a very long flight a great proportion of it would be taken up by the fuel. For shorter distances the lift which could be set aside for paying load would increase. If the route on which such a ship was used were to be divided into stages of approximately 1,000 miles each, the "PL27" could carry a crew of seven, sufficient fuel to leave a safe margin, and, in addition, have accommodation for about twenty-five passengers. It will thus be seen that, as regards earning capacity, the "PL27" should be a very useful craft as a passenger and mail ship, especially as her cruising speed is said to be about 60 m.p.h. It is estimated that these airships could be built in England for not more than £30,000 each, and if built in batches, the cost should be even lower. Thus, by reducing the length of the stages flown to approximately 1,000 miles, a much more economical service should be possible than if large rigids, capable of doing the London-Cairo trip without landing, were employed. In this way, the time for the journey to Australia, for instance, would be somewhat increased, but, on the other hand, it is at least conceivable that a greater revenue would be forthcoming, as it should be easier to fill up the ships with passengers for shorter distances over portions of the route.

As regards the design and construction of the Parseval "PL27," this ship is, to some extent, based upon the Italian designs in which there is a keel structure running the greater part of the length of the airship, and to which are attached some of the heavier local loads such as petrol and water tanks, central engine



The 18-Ton Parseval Semi-Rigid Airship "PL27"



View of the forward position of the airship, showing the control car

cars, etc. This structure is so designed that its parts form, as it were, the links of a chain. In the "PL27" the keel, which is about 330 ft. long, is divided into fifty-two separate cells or units, the whole being so designed that the keel can resist longitudinal loads, but not bending moments, owing to the manner of joining the cells to each other. The keel is built up of a tubular framework, consisting of four main longitudinals, struts and wire bracing.

Three of the cars, the control car and the front and rear engine cars, are attached direct to the keel, while the two side engine cars are slung by cables from the envelope, and steadied laterally by struts to the keel. The attachment of the keel to the envelope is by rigging wires and fabric. As already mentioned, the keel serves to support, in addition to the three cars, the petrol tanks and water ballast bags.

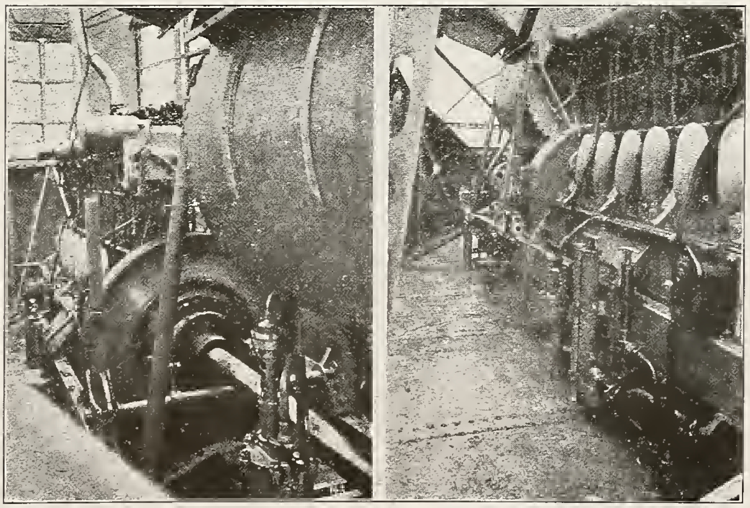
The latter are of two kinds. One is known as "trouser" (*Hosen*) bags, and are emptied singly by means of a ripping line from the control car. The other kind has valves, and is emptied, also from the control car, two at a time. All the bags are of 200 kilogs. (440 lbs.) capacity. The "trouser" bags are mounted four forward and two aft. The ordinary bags, of which there are thirty-six, are distributed along the keel, the valves of every two bags being connected to one control line, so that with these 880 lbs. of water is discharged at a time. The total amount of water ballast carried is thus 8,400 kilogs. (18,500 lbs.).

The petrol tanks are hung in the keel, as shown in one of the accompanying photographs. Normally, thirty petrol tanks are carried, twenty-six main tanks and four gravity tanks, one for each engine. The capacity of each tank is 200 kilogs. (440 lbs.), so that normally the total petrol capacity is 13,200 lbs. (nearly 2,000 gals.). Provision is, however, made for slinging another ten petrol tanks in the keel, bringing the petrol capacity up to 8,000 kilogs. (17,600 lbs., or about 2,500 gals.) if long journeys are contemplated. The list available for paying load is then, of course, correspondingly decreased. In fact, by the time one had counted in a crew of about ten, with their provisions, there would be little more load available.

As regards the placing of the petrol tanks in the keel, they are arranged in three groups, corresponding to the arrangement of the engine cars. The forward group, feeding the front engine, consists of six main tanks and one gravity tank. A similar number and arrangement feed the aft car, while the central group, which supplies the two wing engines, consists of fourteen main and two gravity tanks. All the tanks are arranged for easy slipping in case of emergency.

The arrangement of the cars will be understood from a reference to the accompanying photograph of the airship in flight. The control car is placed right forward. A short distance aft of this is the forward engine car, under the keel of the airship. Approximately half-way along the length of the ship are the two wing engine cars, some distance out from the center line, and finally near the rear end of the keel is the aft engine car. Each of the engine cars contains one 240 h.p. Maybach engine, driving pusher screws through reduction gearing and clutches. The engines are mounted with their crankshafts about 10 ins. above the floor of the car, and the lower part of the crank-case can be reached by removing a loose floor plate. The transmission includes a reverse, two wheels being in mesh for forward and three for reverse. The reduction is such that, although the engines run at 1,400 r.p.m. at full power, the propellers run at 180 r.p.m. only. Their diameter is 14 ft. 9 ins. A blower, or fan, placed in the stern of the car, is driven at a speed of 1,850 r.p.m., by means of a silent chain, and delivers 2½ cubic meters (88 cubic ft.) of air per sec., at 100 mm. of water. The engine cars have a length of 6 meters (19 ft. 8 ins.), a maximum width of 1.8 meters (5 ft. 11 ins.), and a height of 1.6 meters (5 ft. 3 ins.).

The control car is 9 meters (29 ft. 6 ins.) long, 2 meters wide (6 ft. 7 ins.), and 2 meters high. It is divided into three compartments, of which the forward one is the control cabin, and the aft one the wireless compartment. From the central compartment access to the keel is gained via an automatically closing trap door, and a shaft leads through the hull to a platform on the top of the envelope. In the control cabin the rudder control wheel is placed forward and slightly over towards the starboard side. The elevator control



Views inside the port engine car. On the left, the engine, clutch, and air compressor; on the right, close-up view of the engine and blower wheel is placed on the port side. The control cabin is, of course, provided with a number of instruments, as well as with the controls for gas and air valves, etc.

The hull or envelope of the "PL-27" is made of three-ply fabric, of which the inner and outer layers run longitudinally, while the middle layer is placed at an angle of 45 degrees. The tearing strength of the fabric is stated to be 2,000 kilogs. (4,499 lbs.) per meter width. In addition to this strong fabric, the hull is strengthened by so-called trajectory bands. These are bands of webbing, about 2 ins. wide, stuck to the envelope fabric and covered with water-tight cover strips. The use of these bands constitutes, we believe, a Luftfahrzeug-Gesellschaft Patent. The tearing strength of these bands is 1,320 lbs.

The gas space is divided by three fabric bulkheads, into four compartments, of which the forward and aft have a capacity of 6,260 cubic meters (220,500 cubic ft.) each, while the other two have a capacity of 9,390 cubic meters (331,500 cubic ft.) each. The fabric bulkheads are reinforced with webbing and are capable of carrying a difference in pressure between their two sides. If, for any reason, it should be necessary to equalize the pressure in two adjoining gas compartments, this can be accomplished by a hose which is normally kept closed by being tied up, but which can be opened by the crew.

Each gas compartment is provided with an air bag or ballonet, which when completely filled occupies 52 per cent. of the gas compartment volume. Thus, the capacity of the fore and aft ballonets is 3,250 cubic metres (115,000 cubic ft.) each, and that of the second and third ballonets 5,000 cubic metres (176,500 cubic ft.) The ballonets consist of two portions, the lower of which, attached to the envelope, is made from two-ply fabric, of a tearing strength of 1,200 kilogs. per metre width, while the upper part is in a single thickness and has a strength of 900 kilogs. (2,000 lbs.) per metre width.

Each of the gas compartments is provided with two gas valves, placed in shafts and discharging through the top of the envelope. The openings on the top of the envelope are covered with fabric hoods. Each ballonet has two air valves, built into the keel, and having discharge pipes leading into the open. In addition, each ballonet has an inlet valve of the flap type, serving to admit air from the fans. The four flap valves communicate with a common pipe or hose, into which all four blowers discharge. Each ballonet has also a pressure regulator (automatic) which ensures that there is always an excess of pressure of 25 mm. of water. Should the pressure fall to 23 mm., the regulator opens the inlet valve, which communicates with the common pipe from the blowers and keeps it open until the old pressure has been established, when the valve is closed. If the pressure rises to 27 mm., the pressure regulator opens either the air valves of the ballonet or the gas valves of the gas compartment, or both, according to the setting of the switches in the control car. The actual operation of pulling the air or gas valve cords is carried out by the automatic regulator, although when required, as, for instance, in landing, members of the crew can operate the valves direct, without the action of the regulator.

Two views of the port engine car. On the right can be seen the struts which brace the car to the keel structure

The tail planes are so attached by struts, etc., that they cannot be pressed into the envelope. They are designed for interchangeability, the fins and tail planes being identical. The elevators are, however, different in shape and size from the rudders.

Altogether, the Parseval "PL27" is a very interesting airship, and it has proved that it is possible to design even quite a large ship without necessitating a change over to rigid construction. It is confidently expected by the *Luftfahrzeug-Gesellschaft* that, if desired, even larger ships can be built on this principle, but even taking the "PL27" as she existed in 1916, the type should have a considerable sphere of usefulness at the present time, and the type has the advantage of having been tried out to the satisfaction of the designers, behaving well during maneuvering, and showing a good turn of speed. It may be expected that when Germany is once more free to develop, without the present restrictions, more will be heard of airships of this type, and we should not be surprised to hear of regular services being established between Berlin and London, which cities are sufficiently far apart to afford a considerable saving in time by traveling by air, and yet not so far as to necessitate the use of rigid airships.

Reserve Officers Receive Instruction at Mitchel Field

Twelve reserve officers reported at Mitchel Field, L. I., New York, in a body on Saturday, May 13th, for flying and for instruction in installation of radio equipment on aeroplanes. Major Harrison H. C. Richards, Air Service, on duty with the Reserve, was in charge of the party. All of these officers were given flights, which took up largely refresher flying instruction and practice landings. To date, no reserve officer who reported at this station with proper credentials, authorizing participation in aerial flights, has been refused an aeroplane.

The Army pilots charged with the duty of giving this refresher instruction to the many reserve officers reporting at Mitchel Field report that these officers get back into shape very rapidly.

The Air Service Mechanics' School

At the present time there are 550 students undergoing the various courses of instruction at the Air Service Mechanics' School at Chanute Field, Rantoul, Ill. This leaves an approximate number of 110 men awaiting instruction. These men will be entered within six weeks. The entrance of this number of men will exhaust the last of the men enlisted in the recruiting drive some six months ago. There are now sixteen courses of instruction in active operation.

Photographic Missions Completed

Lieutenants Robert E. Selff and Wm. C. Goldsborough, have completed their seven thousand mile photographic mission, having photographed all available landing fields in Northern California and Nevada. They landed at Crissy Field while the Flying Circus was in full blast, and were heartily greeted by their flying "Buddies".

On Friday, May 26th, Captains W. A. Bevan and R. G. Irwin and Lieutenants J. P. Richter and C. R. Weber landed at Crissey Field, after completing their mission of photographing the landing fields of Southern California and Nevada. An 18,000 ft. high sandstorm was encountered by them on their flight across Death Valley, which, it is believed, is the reason for the copper tipping on their propellers being so shiny.

The Handasyde Type H.2 Monoplane

The Fuselage

The fuselage—which is apparently the least novel part of the machine—appears to be of the normal three-ply covered type now so widely in use. Actually it has a number of novel features, and is not quite so commonplace as it might at first appear. It is really of the braced longeron and strut type, the bracing being performed by the ply wood skin. The "struts" are in the form of hoops, which also act as formers.

This fuselage is built in two parts, the forward one an engine-carrying nose, and the after part, which contains cabin, etc., and carries the tail. The main fuselage body is built on four longerons—each one of which is in three straight lengths. The forward length, of spruce, covers the space occupied by the pilot's cockpit. Over this space the longerons diverge rapidly in side elevation from front to rear. There follows a second straight length, corresponding to the passenger cabin, which is also of spruce. Over this space the four longerons are parallel. From the rear of the cabin to the tail longerons are of ash. The top longerons over this section slope down very slightly towards the tail, the lower longerons sweep up very considerably.

Joints between these longeron sections are of the simple fishplate type, and are covered by three-ply skin—so that the main body of the fuselage is not a dismountable structure.

The front frame of the forward section consists of four spruce members, with three-ply cornerpieces. There is an intermediate set of four spruce struts and thereafter follows the hoop structure of the cabin.

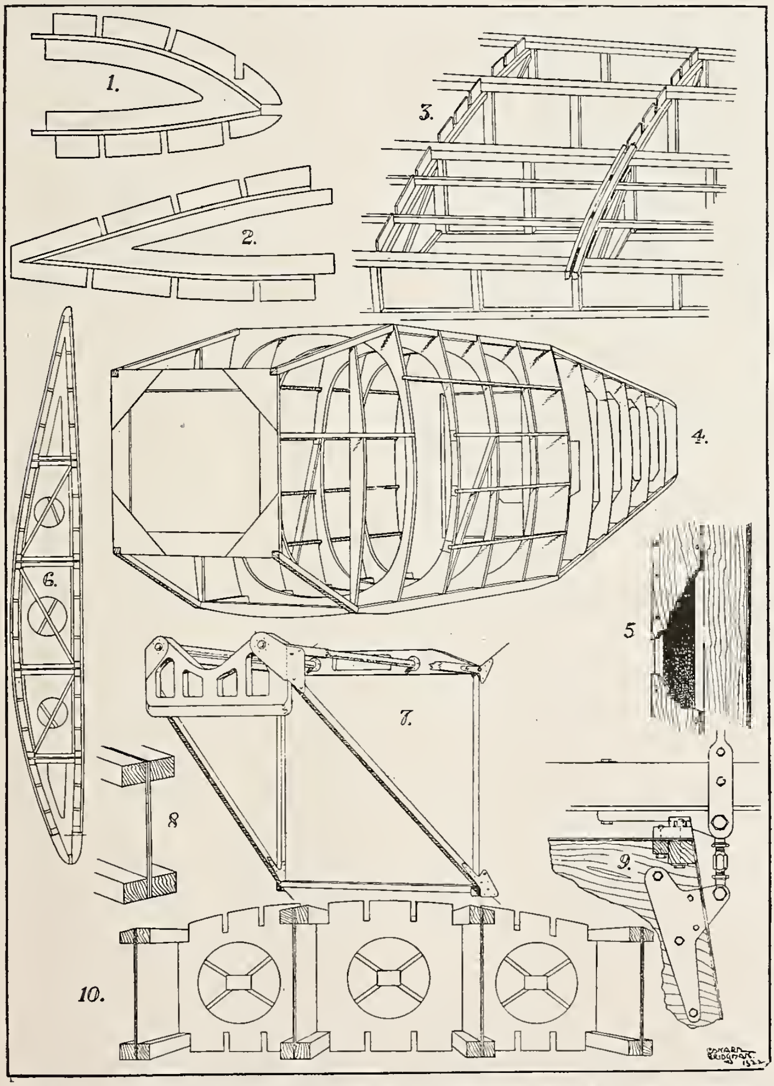
The hoops—which are in effect the fuselage struts, in this cabin portion—are of box section. The inner member of each box is a bent hoop made of ash in two plies. The outer members are of spruce, and the sides of the box are formed by three-ply. The whole structures are glued and screwed together.

The after "hoop" at the cabin end has the three-ply sides of the box extended inwards, and a door-frame worked into the structure, thus partitioning the cabin from a mail compartment which is immediately aft of it.

Aft of the cabin, the struts are built up of spruce only, but are in general of the same type of shape as the cabin hoops. The first beyond the cabin is three-ply covered to form the bulkhead of the goods space, but is fitted with a sliding door so that one may crawl into the after part of the fuselage for inspection. At the rear end of the body there is another solid bulkhead just forward of the front spar of the tail plane.

Over and above the four main longerons there are numerous stringers of spruce from the front of the cabin to the tail. In the cabin length these stringers are continuous, except for the necessary stoppage at the door, which is arranged between the first two of the cabin frames. They are let into the outer spruce members of the hoops. Over the after part these stringers are stopped at each frame, and serve only to support the outer skin. The skin of three-ply is screwed to all frames, longerons, and stringers. Joints in the three-ploy are made by butting the two sheets, applying a "fishplate" of three-ply about 4 inches wide on the inside only, and riveting through from skin to "fishplate" with hollow rivets of about 3/16 diameter pitched about 3 inches apart.

The general appearance of a fuselage framework uncovered is shown in one sketch. A succeeding sketch shows the engine-carrying nose which is attached to the main body. This nose consists of two ash members on each side, which meet at a forward cross member of five-ply spruce. The engine bearer tubes run from the front cross member to the upper cross member of the bulkhead in front of the pilot. This nose does not form a



Details of the Handasyde Monoplane.—(1) the nose and (2) the tail of one rib former. (3) Part of the main wing structure, showing the four main spars and two ribs. The left hand rib is without capping strips. The through stringers are in place between the two nearest spars, and the capping strips are in place over the first section of the right-hand rib. (4) The skeleton of a fuselage seen from the front. (5) Section of one of the fuselage main hoops, showing construction. (6) Elevation of a complete rib (compare figs. 1, 2, 3, 4). (7) The nose of the fuselage. (8) Diagram of wing spar structure. (9) Attachment of a wing spar to the fuselage. (10) End view of a wing root, showing spars and four sections of the formers for a rib detachable engine mounting, because the after support for the engine bearer is part of the main fuselage structure. The nose is however removable after taking out engine and bearers, and this appreciably simplifies packing up the machine for transport.

WING STRUCTURE

The structure of the wings is the most interesting part of this machine. The machine is of the cantilever monoplane type, with the wing entirely above the fuselage. The whole conception of these wings is unusual. They are of the multi-spar type, with a wooden covering, and apart from the joints between the wings and the body, the two halves of the wings, and aileron hinges and control mechanism the only metal parts employed are screws.

The wings are heavily tapered, both in plan and in section, from root to tip. The leading edge sweeps back slightly, the trailing-edge very pronouncedly. The section is an unusual one. The top surface is of the usual type, with its maximum camber in the region of 1/3 the chord from the leading edge. The lower surface is practically flat over the spars, but slopes down sharply from the leading edge to the front spar, and somewhat less sharply up from the rear spar to the trailing edge. The section therefore is biconvex. The four spars, which are spaced at approximately equal intervals across the chord, are all of the H section built up, with top and bottom flanges of spruce in two halves, and a web of spruce two-ply, which web is covered with glued on fabric. The flanges are glued and screwed to the webs.

The ribs are formed of three-ply built in sections which fit into the recesses in the spars. They are stiffened with spruce members glued and screwed to them, roughly parallel to the wing surfaces, but considerably inside those surfaces. The outer edges of these rib webs are notched between spars, the through-going spruce longerons are run through the notches. There are two of these stringers between each spar. Over the stringers is applied a set of continuous spruce laths, which form the rib flanges proper. These are screwed to each spar and stringer. The covering consists of strips of spruce, corrugated internally, which are laid on parallel to and flush with the rib flanges, and are also screwed to each stringer and spar. This spruce skin serves the purpose of drag bracing, and also as the top and bottom flanges of the composite girder formed by the whole structure. The leading edge and the trailing edge are formed by three-ply formers similar to those between spars, which are supported by the through rib flanges. These are also provided with longitudinal stringers running right through. The leading edge proper is formed of three-ply bent to trough section, screwed to the leading stringers, which are of extra heavy section. The trailing edge is of solid spruce.

The details of this very novel wing structure are well shown in some of the accompanying sketches.

The wings are built in two sections, which join on the centre line of the machine. Owing to the fact that except in the case of the front spar, all spars meet at an angle, it has required form of joint. A sketch shows how some ingenuity to obtain a simple the difficulty has been overcome.

The wings rest on the top rail of the fuselage over the cabin. An aluminum block is fitted beneath each spar, and this block carries at its outer end a downward projection which registers on the outside of a mating block of the same material on the longeron. This block on the longeron is fitted with two upwardly projecting tongues, one of which registers on each side of the block on the spars. Therefore when each set of these blocks is properly engaged, the wing is accurately located both laterally and longitudinally in reference to the fuselage.

The lift load from the spar is taken to the main fuselage structure through one right- and left-hand screw adjuster—generally of the nature of the ordinary wire strainer, which is coupled at the top to a strap surrounding the spar and at its bottom to a lug attached to one of the main fuselage frames.

From this description and from the sketches it will be realized that this machine has many features of great novelty and interest. The type of construction is necessarily somewhat expensive at the outset, but as soon as the necessary jigs are set up repetition should be extremely cheap. The absence of complicated metal fittings allows the machine to be built by any competent staff of woodworkers, and if in fact the type proves to be free from trouble due to warping of the timber, it may prove to be a serious rival to metal structures in the future.

The Aeroplane.

A New Czecho-Slovak Commercial Biplane

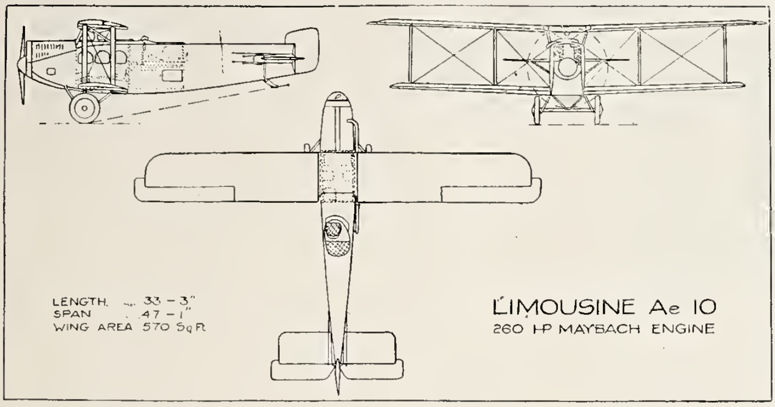
IN the first commercial aeroplane to be designed and constructed in Czecho-Slovakia this re-born country has demonstrated that, in spite of the fact that up to a few years ago its aviation industry was conspicuous for its absence, it is already capable of taking its place amongst the foremost aircraft constructing nations. This new commercial machine has just been turned out from the works of the Aero Aircraft Factory of Prague, whose designers, MM. Husník and Vlasák, are to be congratulated in having produced a machine the general lines of which at once strike one as being both practical and pleasing to the eye.

The Limousine Ae 10 was designed to meet the needs of the growing demand for aerial intercourse with neighboring countries, the Republic being determined to take an active part in the various aerial services running, and to be run, to and from Czecho-Slovakia. It is a tractor biplane, with a deep *fuselage* of good streamline form. The engine, a 260 h.p. Maybach Mb. IVa, is mounted in the nose and drives a 10 ft. 3 in. tractor screw. The radiator is mounted behind the latter, and has been found to give very satisfactory results, causing little resistance.

Behind the engine is an enclosed cabin accommodating three or five passengers, and separated from the engine compartment by a double metal-covered partition as a precaution against fire. The cabin is very roomy, well upholstered, and has double walls, ceiling and flooring, giving an exceedingly strong construction; it is also isolated and noise-proof, and so adds to the safety and comfort of the passengers. Three windows, glazed with Triplex, on each side of the cabin give a good range of vision, whilst the rear window may be used as a direct communication between the cabin and the pilot—conversationally, of course.

Access to the cabin is by means of a door on the right-hand side of the cabin. In the cabin are three comfortable seats, and two tables which are upholstered underneath, so that they can be tilted up and used as seats when two extra passengers are carried. At the rear of the cabin is a space for luggage, measuring 5 ft. 10 in. by 3 ft. by 2 ft. Above this is the pilot's cockpit, just behind the main planes, from which an excellent view in all directions is obtained. Provision is also made for the accommodation of a navigator, who has a seat just behind the pilot, and both can easily change places if desired. A fire extinguisher, in direct communication with the engine and carburetor, is also located in this cockpit.

The main planes are in five sections, the lower in two attached direct to the *fuselage*, and two upper attached to a small center section. They are set at a dihedral angle, but no sweep-back, and the top plane has a very



slight overhang. Balanced *ailerons* are fitted to the top plane only. The main petrol tank is carried in the top center section, whence the petrol is led by gravity through a single pipe, *via* a filter, direct to the carburetor. The petrol system is thus of the simplest form possible. The tank is filled by means of a special pump, and the petrol passes through a filter before entering the tank.

The tail planes are of tubular steel construction, fabric covered, and consist of an adjustable rectangular horizontal stabilizer, mounted between the upper and lower *longerons* just above the line of thrust, two balanced elevators hinged to the stabilizer, and a balanced rudder. No vertical fin is fitted, as the flat sides of the *fuselage,* which tapers to a deep vertical knife-edge, renders this unnecessary. The controls are of the conventional type —elevator and *aileron* column, and rudder bar.

Special attention has been given to the undercarriage, as it was realized that many of the accidents are caused by faulty landing gear. The two wheels are of large diameter—960 mm.—with the object of enabling the machine to land on very soft and uneven ground. They are located well forward, which has the effect of giving a quick pull up. The wheels are mounted on a divided axle, with rubber shock absorbers, which is carried by twelve steel struts, having six points of attachment to the *fuselage.* These struts are arranged in three pairs of "M's, when viewed from the front, as indicated in the accompanying general arrangement drawings. Landing shocks are thus well distributed over the *fuselage;* in places the factor of safety is about 12, both in the landing chassis and cabin. Throughout the machine double wiring is employed.

The principal characteristics of the Limousine Ae-10 are:

Span	47 ft. 1 in.
Chord	5 ft. 9 in.
Length	33 ft. 3 in.
Height	11 ft. 8 in.
Area of main planes	570 sq. ft.
Useful load (3 pass.)	1,650 lbs.
Weight, fully laden	1,620 lbs.
Weight/sq. ft.	8.2 lbs.
Weight/h.p.	17.7 lbs.
Speed	93 m.h.p.
Duration	4 hours
Engine	260 h.p. Raybach

—*Flight.*

Weather Forecasts

In its desire to have its forecasts, warnings, and information made of the greatest possible benefit to aviation and aviation interests, the United States Weather Bureau has arranged a plan of cooperation with the Chief of Air Service, U. S. Army, by which it is hoped closer contact may be established between its aviators and Weather Bureau officials in the field.

The plans of this cooperation have been announced by the Chief of Air Service to all commanding officers of Air Service fields in a letter which describes the arrangement.

In this letter the Weather Bureau requests that, in order that the personnel of the Army Air Service and the Weather Bureau may become personally acquainted and by so doing be able to discuss the possibilities and limitations of their respective services, the pilots at the various Air Service fields in their regular training fly to the various Weather Bureau stations shown on the Weather Bureau map which are within a radius of 300 miles from such fields, become acquainted with the personnel at such stations, discuss the problems of the two services, and arrange a system of cooperation. The prevailing weather conditions of the particular section of the country involved should be discussed as bearing upon the work of the Air Service. On these trips the pilots should make notes of the terrain flown over and the landing facilities en route and at the destination.

The Weather Bureau deems it advisable that lectures on the general work of that Bureau, the weather conditions of the particular country where Air Service fields are located, and meteorological subjects pertinent to aviation should be delivered to the Air Service personnel, and the Chief of the Weather Bureau invites applications from Air Service Fields with the purpose in view of making arrangements for the delivery of such lectures.

Aviation forecasts for the six aviation forecast zones of the United States covering the country east of the Mississippi River are broadcasted by Radio from the Naval Radio Station at Arlington at 10:30 a. m. (5950 CW) and at 10:00 p. m. (2650 CW). The Weather Bureau requests that arrangements be made to have radio operators on duty at Air Service stations within these zones receive these forecasts. The night forecast will cover weather conditions in the zone until noon of the following day, whereas the morning forecast will cover weather conditions from noon until midnight.

The Washington *Post* and the Washington *Herald* publish each morning a special forecast furnished them by the Weather Bureau for routes from Washington, D. C., to Norfolk, Va., and from Washington, D. C., to New York City, and arrangements will soon be made for a similar forecast for the route from Washington, D. C. to Dayton, Ohio.

Request for information on weather conditions from Air Service fields, whether made by telegraph or telephone, are to be without expense to the Weather Bureau; but any aviator of the Army who has made a landing at a point not near an Air Service field is permitted to send a prepaid telegram to a Weather Bureau office for the purpose of obtaining the latest forecasts and information as to prevailing or conditions. Weather Bureau officials receiving such messages are instructed to reply promptly, giving the best possible information in answer thereto and transfer same to the sender at the expense of the Weather Bureau, such reply messages to be checked "Paid WEA."

AERIAL AGE

PUBLISHED MONTHLY

Copyright, August, 1922, by THE AERIAL AGE CO., INC.
5942 Grand Central Terminal, New York

Vol. XV AUGUST, 1922 No. 16

Shall Britannia Rule the Air?

A PROGRAM of development of aviation which would give to Great Britain as complete a domination of the air as was her domination of the sea prior to the world war is now under consideration and apparently likely of adoption as a definite permanent policy of the British government. Dispatches from London report that the British press is flooded with aviation propaganda preparing the people for huge government expenditures necessary to float an air fleet, subsidize private commercial lines, aid plane and motor manufacturers, continue experimentation, and train and maintain pilots, observers, and mechanicians.

That is a natural development of the British character and of Britain's many years of experience in the government of an empire stretching around the world. The British government and people have long realized that only through the maintenance of the world's greatest navy could they have full assurance that the lines of communication and trade between the widely separated parts of the empire would be kept open and maintained in any emergency. A dominant navy meant life of the empire.

The rapid rise of the United States as a sea power in the closing years of the world war brought Britain face to face with the necessity of sacrificing this position. The American program threatened to outbuild Britain. The economic condition of Britain was such that it could hardly hope to compete. At the same time lessons of the war and experiments in the sinking of battleships by aeroplanes which followed the war cast considerable doubt upon the ultimate value of battleships as opposed to aeroplanes. There was no certain conclusion that a $40,000,000 battleship would be helpless before a $10,000 aeroplane, but there was a doubt.

The odds were too great to bet against. That, probably as much as anything, was a leading factor in the Washington decision for the limitation of capital ships. But that did not change the British belief in the necessity of remaining dominant among the nations if possible. The great aviation program outlined is a direct result of that conviction. It shows the way for America.

Our dominions extend from the Philippines to the Virgin islands, and from Alaska to Porto Rico. Our responsibilities extend even further—definitely to the tip of South America. We must be in a position to defend and maintain this territory and these responsibilities. If England has, through its envoys, accepted the 5-5-3 naval agreement only with the intention of stopping development on the sea to begin it in the air, our program should be clear before us.

Every British aeroplane should be matched by an American aeroplane. Every British dirigible should be matched by an American dirigible. Every British hangar and landing field and supply station and experimental station should be matched by its equivalent in American territory. Every British expert in the development or operation of flying machines and in aerial warfare or commerce should be matched by an American as good, or better. And then we should have a few extra.

We do not expert to have war with Britain. In fact we intend not to have war. But in any emergency which may arise we should be competent to emerge the victor. We have voluntarily given up what would have been a campaign of superiority on the sea. Thereby we have saved hundreds of million of dollars without additional risk. But that risk comes if we submit to a position of inferiority in the air. No premium is too great to pay for insurance against such a risk.—*Editorial in Chicago Tribune.*

Army Air Service Promotion

THE death during the flight of two officers of the Army air service—those of Captain Thomas H. Shea, Jr., and Lieutenant R. E. O'Hanly—has again called attention to a situation in that branch that is in dire need of correction. Such casualties are of so frequent occurrence as to sustain a record of eight per cent of flying officers who are killed every year. Vacancies created in this way are not filled by the promotion of air service officers, but by transfers to the air service of officers of other branches of the Army. The air service is unfortunate in the position on the promotion list of its junior officers, who, because of their long period of training during the war, now find themselves segregated near the bottom of the single list. Their seniors are in many cases younger in age and only longer in service by a few weeks or months, a circumstance that determines relative place on the promotion list, by virtue of the fact that the average period of training in other arms was about three months as compared with the air service training period of about nine months. The result has been that not only has the commissioning of air service officers been delayed, but, whereas officers of other arms had an opportunity for being initially commissioned in grades as high as field officers, the air service officers were limited to being commissioned in the grade of second lieutenant, with few exceptions. Furthermore, there was lack of promotion in the air service during the war, because it was a new corps. When the single list was compiled after the appointments of July 1, 1920, it was found that practically all of the officers, who were originally commissioned in the air service as flying officers, held the bottom files of the promotion list. That left vacancies in the grades of captain particularly, and these were filled, and are being filled, by officers transferred from other arms, who have had no war experience in air service activities and who are in many instances junior in age. The air service has a total of 900 officers, of whom over 700 are officers commissioned subsequent to April 6, 1920, and of this 700 about 500 are original flyers whose commissions were delayed, so that 200 of them are officers who were transferred from other arms or who came in as ground officers and are ranking the junior officers of the air service. The latest returns of the adjutant general's office show 608 first lieutenants in the air service, while in the infantry, which should have approximately three times as many as the air service, there are but 1,008. The reason for this is that the majority of young officers in other arms, instead of being first lieutenants, are captains.

The situation in the air service in respect to promotion has been the subject of consideration by the special

(*Concluded on page 426*)

THE NEWS of THE MONTH

Navy Gets $6,537,000 to Build New Aircraft

Washington.—Inclusion of a Senate amendment of $6,537,000 in the naval appropriation bill for new construction of aircraft was agreed to June 21 by House and Senate conferees on the annual supply measure. It was the first meeting of the conference.

While the committees were discussing the appropriation measure Senator Pomerene (Dem., Ohio) announced in the Senate he had been informed that Admiral Wilson, Superintendent of the Naval Academy, had notified thirty civilian instructors there that their services were to be dispensed with.

The appropriation bill, as it passed the Senate, carried a provision for reducing the number of civilian instructors from the present 118 to 80 and Mr. Pomerene condemned the reported action of Admiral Wilson as presaging further attempt to get rid of the civilian instructors.

New York Flyers Forming Own Unit

New York is to have a flying unit all its own. There has been at Hempstead a temporary aviation squadron, but these men were part of the 102d Infantry, and when the unit is recruited will be transferred back to the 14th Infantry. Recruiting for the unit, which will be known as the 27th Air Service, has been started and a group of New York men who brought down many enemy aviators during the war have signed.

Among these are Major Kenneth Littauer, who was a member of the Lafayette Escadrille; Capt. G. De Forest Larner, who brought down eight enemy aeroplanes; Capt. Curtis Wheeler, who has six citations; Capt. George A. Vaughan, Jr., who has a record of thirteen enemy machines, the D. S. C. and British, French and Belgian medals; First Lieut. Howard Burdick, who brought down eight enemy planes, and nine other officers who did valiant service in Europe.

General Order No. 16, sent out from the State Adjutant General's office, authorizes the reorganization of the air service for the State Guard. It orders change of station to Miller Field, New Dorp, Staten Island, and allocates the seaplane hangar in the southeast corner of the 300 acres as the armory for the 27th.

Capt. G. L. Usher, U. S. A., is designated as the Regular Army air instructor for the National Guard. Capt. Usher already is in residence at Miller Field. The total strength will be 31 officers and 160 men, including a photograph staff of twenty and five intelligence men.

Tarkio, Mo., Flying Meet

The merchants and business men of Tarkio, Mo., are promoting an aero meet at Tarkio, July 27-8-9, inviting all flyers to compete in events, paying all expenses, such as gas, oil, hotel expenses and entertainment, and giving many cash prizes and cups and trophies. C. E. Tuttle is employed to manage the meet.

Tarkio is the home of Tarkio College, a town of about 3,000 population and very much alive.

The field selected for the meet is an 80-acre blue grass field one and a half miles south of town, with plenty of emergency fields adjoining.

The Larsen Trophy

The Contest Committee of the Aero Club of America on June 30th directed C. B. Wrightsman, of Tulsa, Oklahoma, to return to the Aero Club of Omaha, $3,000 in prize money, which it is alleged, was wrongfully awarded to him following the Larsen efficiency aeroplane contest, held in Omaha last November. This step, it was learned, is the first in the adjustment of a situation which has been the subject of discussion in American aeronautics for many months. John M. Larsen, donor of the trophy, whose entries in the race established undisputed performance, notwithstanding which the officials made the award to Wrightsman, has presented evidence supporting his claim that a fraud was perpetrated. Wrightsman is ordered to return the money within 10 days or be disqualified. Upon return of the prize money, further hearings will be held.

Spokane News

Captain Lowell Smith, one of the army air service's best known pilots and holder of several American air records, landed in Spokane at the municipal field at Parkwater on June 22 in a 400-horsepower De Haviland-Liberty motored plane. He is accompanied by Sergeant Whitefield.

Captain Smith is flying over the west, mapping all municipal and other landing fields for use of the government army flyers. He made the best time in the transcontinental air race two years ago, fighting a close contest with Captain Belvin Maynard, the "flying parson."

On his present trip out of headquarters at San Francisco, Captain Smith and his sergeant have photographed landing fields in California, Wyoming, Nevada, Utah, Boise, Montana and are now completing their map-making work in Washington.

They left next morning for the Coast, stopping en route to take field photos at Walla Walla, Yakima, Pasco, and other central Washington points.

He has covered 6000 miles since leaving California. Captain Smith and Sergeant Whitefield have been assigned to the photographic work by the air service.

The Bellanca Model C. F. Monoplane which made an excellent showing at the Monmouth Flying Meet

On an aerial tour from Buffalo, N. Y., to Siberia, C. O. Prest, aviator, landed in Spokane on June 21. He is making what he claims is the first transcontinental aerial travelogue moving picture ever taken and expects to cover over 8500 miles on his trip.

Prest carries a moving picture camera especially mounted so he can use it while operating the plane, and two ordinary cameras for still pictures. He took several hundred feet of film of scenes along the Spokane river in Spokane.

Aviator Prest has been flying since 1910, having flown first in the old Bleriot monoplane and the old-time Curtiss machines. A month ago he started on his cross-country trip. Before coming to Spokane he took aerial views in and around Glacier park.

La Porte Carnival

The Cleveland Air Transit Company is planning to hold an air carnival at La Porte, Indiana, on August 15 and 16.

Cincinnati News

Cincinnati will have no municipal airport for at least another year, is the announcement made today by C. W. Culkins, executive secretary of the Cincinnati Chamber of Commerce, due to the fact that the Government will not establish a reserve squadron station here and contribute the greater part of the finances. Mr. Culkins made the announcement after a statement to this effect had been received from Senator Frank B. Willis.

Regardless of the fact that there is no field at Cincinnati available for landing, the Cincinnati Aircraft Company is making rapid progress, and during the past week has made several sales, using a field near Harrison, Ohio, for its facilities. A small factory has been established at Second and Sycamore streets, where rebuilding and repair work is being carried on on a small scale. It is understood that this company will secure the services of Mr. D. W. Huntington, aeronautical engineer of Hempstead, N. Y., with a view to building a transportation ship. Negotiations are being carried on between the officers of the company and Mr. Huntington to this end, it was stated by Secretary M. H. Held, of the company.

Mr. H. F. Woolard has been appointed representative of the Cincinnati Aircraft Company for Indiana, with headquarters at Indianapolis.

New Aerological Survey Issued by Weather Bureau

Of special value to aviators is a section dealing with free-air winds, contained in a discussion of free-air conditions of pressure, temperature, humidity, density, and wind, as observed by means of kites, issued as Supplement No. 20 of the Monthly Weather Review by the Weather Bureau, United States Department of Agriculture.

The winds have been classified according to wind direction at the surface, and the average amount and frequency of veering and backing with altitude, increase in speed, percentage frequency of each direction, of north and west components, and of speeds above 10 and 20 meters per second have been determined and are presented in tabular and graphic form.

Many tables and figures are given in the supplement, and also a series of charts valuable to meteorological students. The marked difference between summer and winter conditions in the free air, as at the surface, though in less degree in the former is well brought out in these charts.

It is a significant fact that the average direction and rate of movement of storms across the country are very nearly the same as the average wind direction and speed at heights of 3 to 5 kilometers. Measurements have been taken by kites up to 5 kilometers, or 3 miles.

This publication, which is available to interested persons upon application to the Weather Bureau, is Part I of an aerological survey, which will later include the diurnal variation at different heights, the results of observations with pilot balloons, and similar information.

Kansas City Activities

Plans for an airdrome which will make Kansas City a leader in aeronautical activities were announced on June 18, by the Flying Club. A 53 acre field, which will be leased to the government and operated under supervision of air service officers is being purchased by Major Howard F. Wehrle, Rogers Crittenden, Frederick H. Harvey, Robert E. Lester and Simpson Yeomans.

The site which has been approved by Major Ira A. Rader, of Fort Crook, Neb., corps area air officer, and Capt. St. Clair Street, a member of the National Airways board, is on the Davenport road a few hundred feet south of Blue Ridge boulevard on the way to Rayton.

Plans for the development of the field are tentative, include:

Eight hangars, arranged about the rectangular field, two garages, and a machine ship, motor car parking space, a grand stand with a capacity planned at five thousand, space for a clubhouse for the flying club, space for an aviation school, where civilian fliers may be trained. This would be a privately owned concession.

Quarters for the civilian flying school, barracks and similar enterprises, and a field marker in the center of the field with "K. C." lettered in colors on a white background.

The field will be used by the government and civilian aircraft. It will be used by the government for army operations and training purposes. Principally for the training of reserve officers. Also the air mail will be accomodated at this field in addition to the establishment of the national guard aviation squadrons at this place.

Boston is the only city which has taken advantage of the government plan of leasing privately purchased ground for an airdrome, so far. Other cities which have similar plans are San Francisco, Chicago, New York, Los Angeles and Minneapolis, it is reported.

Major Wehrle who was active in securing the field, is particularly well equipped to direct successfully a project of this kind.

Pilot Chas. Pedley and Mrs. Pedley, who are doing good work in the Southwest and West

He superintended the laying out of Hazelhurst field, Mineola, New York, the first government school in the East and the second in the United States. He was one of the early aviators who took training with the Curtiss company in 1916. When the war broke out, he was a Captain in the air service, and was immediately assigned to the task of preparing plans suitable for aviation fields. His plans were copied by various fields about the country.

According to the plans of the five men, an Air Terminal association will be established and incorporated with $40,000. Stock will be sold, and facilities on the field will be provided for by the corporation. Five hundred square feet of ground on the terminal field will be let to the flying club for the building of a clubhouse. In addition the club will carry on their activities on this field free of rent or charge. The old American Legion field at Sixty-seventh street and Belinder road will be abandoned as soon as the lease expires on November 1, 1922. A new hangar there which is nearing completion will be moved to the new field, according to plans of the flying club. Also all other facilities will be transferred to the new field or other points. There are now twelve ships on the present field, all actively engaged in flying. Much of the flying is done in passenger carrying and training of pilots.

Following the announcement of the plans for the terminal, Mayor Frank Cromwell voiced approval of the new enterprise and urged the early developments, that Kansas City might get ahead as rapidly as possible.

"It is not only a matter for those who are directly interested in flying to think about," the Mayor said, "but it is a civic matter and will be a distinct asset to Kansas City."

At present the final details and purchase of the field depends on Washington. As soon as the lease is signed by the government, work on the hangars and the field will commence. It is said that the new airdrome will be completed by the first of the coming year.

The Air Service plans to send ten planes and a detachment of six men, one officer and five enlisted men, who will supervise activities.

At a meeting of the flying club in the hotel Baltimore, June 22, evening, after three hours' debate, the club decided to indorse the project and accept the plans of the terminal association. At first much opposition to the plan was voiced by Francis Poindexter and a committee of four men. They argued that should the club accept the proposal of the association, Kansas City's aerial activities would fall entirely into the hands of five men, that the club would lose its prestige and would no longer be the city's leading faction in the promotion of flying.

Several squadrons of reserve officers of the air service are established in the vicinity of Kansas City and with these organizations eager for active participation in flying along with civilian flying much activity is apparent for Kansas City. Two manufacturing concerns are considering branch factories here in addition to three air lines which are proposed from Kansas City to Chicago, from Kansas City to Oklahoma City and from Kansas City to St. Louis. The main sales office of the Huff Deland aero corporation is established here, and plans are on foot to move the factory from Ogdensburg, N. Y. to Kansas City. Also the Longren Aircraft of Topeka, and the Laird Swallow company of Wichita are now preparing plans for active work in Kansas City. The Laird Swallow company is establishing a regularly operated air line between Kansas City and Wichita which will be in operation as soon as two large planes for the purpose are completed.

Petitions for the establishment of an air mail terminal are also under advisement. The association hopes to bring this service through Kansas City before the year expires. Two new flying schools are in preparation, and in addition to passenger work, much of Kansas City's advertising in the nearbly states is carried on by aeroplane. The Victor Oil company here have two planes which are used to carry their salesmen about the country.

Spokane News

Co-operation of local aircraft companies, centralization of activities and a comparatively small amount of money spent on the Parkwater municipal field will give Spokane aviation facilities second to none, Captain Lowell H. Smith, famous army flyer, said while in Spokane recently.

In his big De Haviland plane, driven by a 400-horsepower motor, he left Spokane, circled the field, the city and Fort George Wright, while taking aerial photographs, and then soared away to the west, headed for Yakima.

In the interests of the Army air service Captain Smith and his aide are making a 6,000-mile trip over the West, mapping the principal landing fields. He will take back pictures of 75 fields when he reaches headquarters at the Presidio, near San Francisco.

"Parkwater Field is the best I have seen since leaving Cheyenne, Wyo., which is on the Government aerial mail route," Captain Smith said. "It is large enough for a four-way field and one of the best in the country. The city or somebody should devise some means of clearing parts of the field of rocks which now dot the surface and which might cause someone to damage a ship.

The Dirigible Mooring Tower at Lakehurst, New Jersey

"Your aerial activity at Spokane should be centralized. All flyers here should co-operate to make the business a success and should all put their ships at the one field. With all flying from one field, there would always be someone ready to go into the air and far better results would be obtained."

Captain Smith says Spokane has one of the few fields in the West suitable for teaching beginners flying work. Its size, he said, affords beginners far greater safety.

The Commercial Club at Walla Walla, Wash., obtained an indefinite lease on a tract of land one mile east of the city for use as an aviation field. The land is owned by Eugene Tausick and the Baker Langdon Company and can be leveled at little cost. The owners agreed to let the club use the land without cost. Several automobile dealers have agreed to furnish tractors to help level the ground. This is the first step in a movement to put Walla Walla on the aerial route. The field will be available to any aviator who happens to be traveling through and will be suitably marked so that it can be plainly seen from the air.

Air Mail Performance

At 12 o'clock Sunday night, July 16, the Air Mail Service of the Post Office Department completed a year's daily service without a single fatal accident. During this time the planes flying on the New York to San Francisco route covered 1,750,000 miles. More than 49,000,000 letters, totaling 1,224,500 pounds, were transported.

The record of the Air Mail Service for the past year proves more conclusively than any other test ever made the reliability and the efficiency of the aeroplane in commercial service. Through every kind of weather, summer, fall, winter and spring, and over mountains, deserts and forests, the Post Office Department air mail planes flew. The percentage of trips actually completed was 92.5 per cent, as compared with 83 per cent for the last fiscal year. The percentage of scheduled miles actually flown was even higher, totaling 94 per cent.

While routes totaling 820 miles were discontinued during the last fiscal year and only the transcontinental route of 2,680 miles maintained, the Air Mail Service nevertheless carried the same amount of mail as it did last year, or 23 per cent more in each aeroplane load.

Officials of the Air Mail Service attribute the record of no fatal accidents in a year to the fact that all their pilots now are experienced and tried and they know the route. That the pilots of the Air Mail planes of the Post Office Department are top-notch among the flyers of the United States was established at a recent Midwestern flying meet at Monmouth, Ill. Here the flyers of the Air Mail Service took five events of the eight and six cups of the nine given as prizes. The mechanics, too, are more experienced. Last year was a pioneer year. Then the pilots were learning the routes they were flying and the field and hangar equipment was inadequate. During the fiscal year ending June 30, 1921, seventeen people died in accidents in the Air Mail Service. Many of the fatalities occurred with the metal monoplanes which were abandoned. During the last fiscal year one pilot was killed. His death occurred on July 16, 1921, but no man has met death in the Government Air Mail Service since then. In the last year no flyer has been in the hospital more than five days.

The Air Mail Service is now maintaining sixteen stations on the ocean-to-ocean route. Fifty-six planes are ready to fly. In addition, some are being overhauled and some are in storage waiting to be assembled. The Air Mail Service is employing forty of the most expert pilots in the United States. The total number of men employed to fly the planes and to keep them in repair is 372. Every day twenty-one pilots and planes are in the air, flying approximately 6,000 miles. The speed possible by the use of the Air Mail is shown by the fact that mail sent from New York has been delivered in San Francisco three days later.

The Post Office Department expects to establish night aerial mail service on the transcontinental route within this fiscal year. At present the planes are used chiefly to advance mail delivered too late to catch trains on which earlier mail left, but night flying planes will carry mail from New York to Chicago or from Chicago to Cheyenne.

(*Concluded from page* 401)

a definite plan. For months there had been under consideration a flying meet and congress, but definite action was not practicable until the last fortnight, when a representative of the Chicago Aeronautical Bureau called on us. The plan is to hold a flying meet and convention, August 4 to 13, to which no admission will be charged. The purpose is to develop Chicago's position in air transportation. The president of the Chamber and others, including Messrs. Curtiss and Redden, have accepted invitations to speak. The meet, as presented to us, has our hearty approval and it is recommended that the Chamber sanction it and otherwise assist it in every way possible.

Aeronautical Institute: There has been under consideration the desirability of an Aeronautical Institute. It now appears that at the time of the Pulitzer Races in Detroit the program of the Detroit Aviation Society includes the organization of an Air Congress in connection with the effort that is being made to perfect the National Aeronautic Association. In the replies that we have received to our questionnaire on this subject there is considerable divergence of opinion on this subject. This, in a measure, is due to a misunderstanding of aims, scope and purposes of such a plan. Many of our members assumed that an Air Institute would be limited to consideration of engineering problems and consequently recommended that the work be left entirely to the S. A. E. As a matter of fact, a program for an Aeronautical Institute would not only include papers on engineering subjects, but consideration of questions of aerial law, national and international policies, insurance, military and naval use of aircraft, organization of aerial transportation companies, both as to personnel and finance, etc., etc.

Co-operation with Local Chambers of Commerce

As we are increasing our contact with local Chambers of Commerce we receive increasing demands from these organizations for co-operation. They are gradually forming the habit of not only referring to us the peculiar questions of their locality regarding landing fields and the establishment of air lines, but the inquiries that they receive from individuals on aeronautical questions.

Sales Information

We have an increasing number of requests for information regarding sources of supply for aeronautical material, which is regarded as a very wholesome sign, not only as indicating the manner in which our organization is being used, but the increasing interest on the part of the public in aeronautical development.

President Harding's Letter

Following is the letter, mentioned above, which the Aeronautical Chamber of Commerce received from President Harding:

"The White House,
"Washington.

"Gentlemen:—

"I find pleasure in adding a word expressive of my interest in aerial transport, and in the presentation of the subject which is being made by the Aeronautical Chamber of Commerce. The history of civilization is largely the history of communication. Each stage of progress seems to demand and develop improved means of transport. The steamship, the railroad and the motor car have been devised and utilized. Now we enter a new phase. It is a real distinction to America to be known as the birthplace of the aeroplane; it should be our concern that this art shall not languish, but that in its practical application we shall lead the world. An amazing development will take place in the near future in the utilization of the air as a medium of transport and communication. As a government, we are aiming to provide this art with necessary guaranties of law, and with such facilities as may be possible through the encouragement of airways and terminals. But for air transport quickly to achieve the important place it is destined to occupy it must have public interest and support. I hope your efforts in this behalf may be productive of most gratifying results.

"Very truly yours,
"Warren G. Harding.

"Aeronautical Chamber of Commerce of America, Inc., 501 Fifth Avenue, New York City."

THE AIRCRAFT TRADE REVIEW

New York-Atlantic City Service

Passenger accommodations to fill a six-place flying boat daily from Atlantic City to New York have been booked for one month in advance, the Aeronautical Chamber of Commerce announced in connection with the regular daily service each way by Aeromarine Airways. Their flying cruisers will leave the municipal flying station at Eighty-second street, North River, every afternoon at four o'clock. The flying boats will leeave the Curtiss Airport at Atlantic City at ten o'clock in the morning for New York. The trip between the two cities is made entirely over the water. It will require only 75 minutes, as against three and a half hours by train.

B-G Expansion

Owing to the fact that the demand for B-G spark plugs has increased so tremendously the company has had to take larger office and factory space at 136 West Fifty-second street, New York.

Navy Department Test of Wright Engine

The Navy Department has had a quiet way of doing a considerable amount of development work on aircraft engines during the past two years. An interesting evidence of this is the recent completion of test of 250 hours on a Wright E-2 engine. This engine was run for two periods of 125 hours each. One hundred and twenty-five hour runs were continuous, twenty-four hours a day, the only stops being three in each period due to gasoline shut off, trouble with oil radiator leakage, spark plug renewal and the necessity for club renewal, as part of the test was conducted in a rainy period.

This engine was run at the rated horsepower of 180, and a rated speed of 1800 r.p.m. on straight aviation gasoline. While the results of the test are not for publication as yet, it is understood that the Navy Department is well pleased with the tremendous durability shown by the engine and it is also understood that the Wright Company intends to incorporate in future production engines several modifications of the standard E-2 which were tried out during this test. Representatives of the Wright Corporation who observed the test are enthusiastic about the way the men of the Bureau of Aeronautics on duty at the Naval Air Station at Anacostia, D. C., handled the running of this very arduous bit of research work. One of the most interesting points in connection with this endurance test is that the connecting rod bearings, which were the weakest point in the original type "A," 125 H. P. Hispano engines, from which the present engine was developed, ran for the full 250 hours and showed no measurable wear in that period; also that the valves which were regarded as being very delicate in the early engines were in such a condition at the end of the test that they would have undoubtedly run another full period of 125 hours.

Flying School Data Wanted

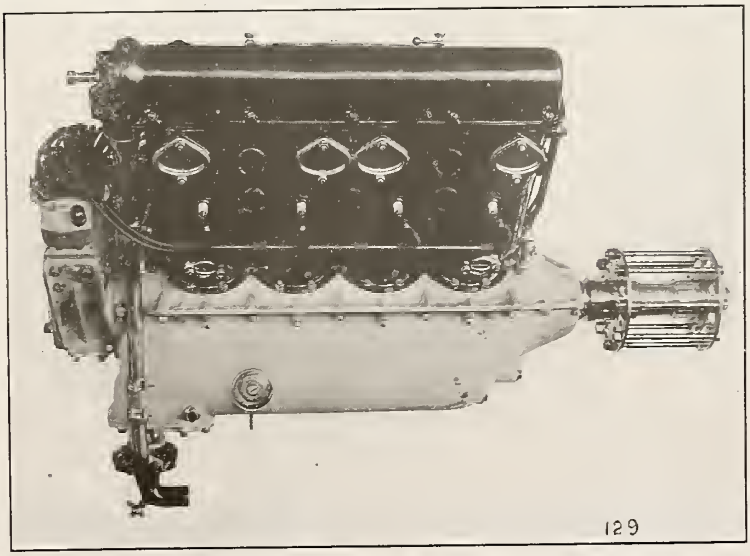
The Aeronautical Chamber of Commerce are preparing data on flying school activities during the past year, and all schools are requested to send the approximate number of pupils turned out during the past 12 months, with photographs of activities where practicable.

Photographic Opportunity

The Aeronautical. Chamber of Commerce has received a communication from Mr. Theodore G. Holcombe, Secretary of the Committee on Post Office and Postal Facilities, of the Boston Chamber of Commerce, 177 Milk Street, Boston, Massachusetts, requesting information relative to the cost, etc. of an aerial survey of Boston. He desires, for his files, the names, etc. of reliable firms engaged in aerial photography, that they may be available in case an aerial survey is decided upon.

Standard Atmosphere

Report No. 147 of the National Advisory Committee for Aeronautics, by Willis Ray Gregg, discusses the need of a standard set of values of pressure, temperature and density at various altitudes and points out the desirability of adopting such values as are most in accord with actual average conditions, in order that corrections in individual cases may be as small as possible. To meet this need, so far as the United States is concerned, all free-air observations obtained by means of kites and balloons at several stations in this country near latitude 40° N. have been used, and average values of pressure, temperature and density, based upon those observations, have been determined for summer, winter and the year and for all altitudes up to 20,000 meters (65,000 feet). These values are presented in tables and graphs in both metric and English units; and in the tables of densities there are also included values of density for other parts of the world—more particularly for Europe. A comparison with these values shows that, except in the lowest levels, the agreement is very satisfactory. A further comparison with



The Wright E-2 Engine, a product of the Wright Aeronautical Corporation values of density determined from Toussaint's law of temperature decrease, $t = 15 - .0065z$, in which t is the temperature in ° C and z the altitude in meters, indicates very good agreement with those values up to 10 kilometers. It is therefore recommended that the United States adopt Toussaint's values of density up to 10 kilometers and the values presented in the tables for all higher altitudes.

A copy of Report No. 147 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Triangle Airways

The Triangle Airways of Chicago operated their two six-passenger flying boats from Chicago to Michigan City on July 4, to transport fans to the Leonard-Rocky Kansas bout. Short flights are made regularly by the company from the old Columbia Yacht Club.

The Slotted Wing

We are in receipt of the following letter from C. A. Wragg, aeronautical engineer, Washington:

In the article on the "Theory of the Slotted Wing" by A. Betz, Gottingen, printed in your issue of June 26th, reference is made to the type of wing system (Fig. 5) in which a wing section is set close behind and below another to make a compound aerofoil unit for normal flight. It is stated that the flow about the forward wing is improved by the proximity of the rear one, but that the effect of the forward wing on the flow about the rear one is such as to detract from the advantage gained.

The writer pointed out this improvement on a forward section in such a wing system years ago, and also stated that not only could the detractive effect on the rear wing be minimized sufficiently to make the arrangement worth while as a fixed non-adjustable system, but that the airflow about a rear section set close behind and below can be affected in such a way as to augment the efficiency of each section and result in improved efficiency of the compound. He claims to be the first to point this out and has for many years advocated and endeavored to instigate a thorough investigation of this Compound Aerofoil.

Qualitative data obtained by the writer indicate that not only can the L/D be improved by embodying the requirements which he specified, but that this can be in a measure affected by reduction of drag at the low angles and values of lift used for maximum speed.

The system can therefore be ideally adapted for high speed, and by making certain simple mechanical adjustments it can be changed during flight to considerably increase the lift coefficient by reducing or closing the gap (the reverse operation of the Lachmann and Handley Page idea) for the purpose of landing and rising.

Aeromarine Airways Opens Great Lakes Division

The Aeromarine Airways, Inc., officially opened a daily flying boat service between Detroit and Cleveland with the arrival of two eleven-passenger, closed-cabin flying boats, the *Santa Maria* and the *Wolverine*, in Cleveland after a 90-minute flight from Detroit on July 14.

On board the *Wolverine*, which was piloted by E. D. Musick, were C. F. Redden, president of the Aeromarine Airways, Inc.; W. E. Metzger, president of the Detroit Athletic Club; Commodore A. A. Schontz, president of the D. & C. Steamship Company; P. J. Reid, managing editor of the Detroit *Free Press;* H. V. Wilcox, of the Detroit *News*, and Roland Rohlfs, Detroit manager of the Aeromarine Airways, Inc.

On board of the *Santa Maria*, which was piloted by D. G. Richardson, were I. M. Upperque, president of the New York Cadillac Motor Car Company, and owner and president of the Aeromarine Plane & Motor Company, the parent corporation; C. F. Ketterling, vice-president of the General Motors Company; Dr. J. W. Inchec, Commissioner of Police of Detroit; Carl Fritchie, of Detroit; Frank Lewis, of New York; T. Norris, motion picture photographer; C. S. Mott, general manager of the General Motors Company, and a representative of the Detroit *Journal*.

The boats arrived at Cleveland at 12:20 p. m. The distinguished passengers were greeted by a committee from the Cleveland Chamber of Commerce. Glenn L. Martin, of the Glenn L. Martin Aircraft Corporation, headed the welcoming delegation. H. A. Bruno, sales and advertising manager of the Aeromarine Airways Company, and Walter Hempel, field representative of the company, were also at the dock when the boats arrived.

The visitors and welcoming committee were driven in Cadillac automobiles from the dock to the Cleveland Chamber of Commerce. The procession was escorted by a troup of mounted police. At the Chamber of Commerce they were met by Mayor Fred Kohler, and Newton D. Baker, president of the Chamber of Commerce, gave an address of welcome and complimented Mr. Upperque and Mr. Redden on the initiative shown by the Aeromarine company in developing commercial aviation in America.

The party returned to the flying boats at 3 o'clock p. m. and at 3:22 p. m. the boats left the water on their return flight to Detroit, arriving there at 4:41 p. m.

The Cleveland station of the Aeromarine Airways, Inc., is at the D. & C. dock at the foot of East 9th street. Tickets and reservations may be made at this station and also at the uptown office of the D. & C. company, 2010 East 9th street.

In Detroit the operating base is in the Memorial Park and the river. The downtown passenger station is at the foot of First street. Tickets may also be had at the D. & C. offices. The operating equipment for this service is up-to-date in every way. Fast motor boats and base floats were shipped from the Aeromarine factories at Keyport, N. J., and are stationed at the different bases. Through the cooperation of Commodore Schontz, Aeromarine passengers have the use of the D. & C. waiting rooms at both cities. The boat schedules are as follows:

Leaves at 9 a. m. from Cleveland and Detroit. Returns at 5 p. m. from each city. The fleet consists of the *Santa Maria*, the *Wolverine*, and a six-seat open boat, the *Niagara*. Another eleven-passenger flying cruiser has been ordered from the factory and will join the fleet within a few days. This boat was named the *Buckeye*.

Air Mail Radio Service

Plans are being considered by the Post Office Department for changing at least a few of the fifteen radio stations operated in connection with the Air Mail Service to provide both radio telegraph and radio telephone service. The stations are at Washington, D. C.; Hazelhurst, L. I.; Bellefont, Pa.; Cleveland, O.; Bryan, O.; Chicago; Iowa City, Ia.; Omaha, Neb.; North Clark, Neb.; Cheyenne, Wyo.; Rock Springs, Wyo.; Salt Lake City, Nev.; Reno, Nev., and San Francisco.

The Washington station has had both radio telegraph and radio telephone service for nine months. Besides maintaining an hour-to-hour record of the progress of air mail, the Post Office Department radio stations now send out other information. Complete weather reports now go out daily. Also reports of grain, dairy and livestock prices travel the ether waves to the farms and farming communities.

It is still uncertain just when the stations will be changed to radio telephone apparatus. Because of the first call on the radio by the Air Mail, the equipping will probably be gradual. Further announcements concerning the new service are expected within a short time.

ARMY and NAVY AERONAUTICS

Navy Prepares for Detroit Races

The Navy is making extensive preparations for the forthcoming aerial contests to be held in Detroit in October and it is hoped and confidently expected that the Pulitzer Trophy and the Curtiss Marine Flying Trophy will fall a prize to Navy contestants.

In the Pulitzer Race, the Navy will make five entries, among which will be the Curtiss Navy Racer CR-1, winner of the event in 1921. This plane holds the world's record for a closed circuit. The CR-2, another entry, is a modification and improvement over the CR-1, and will undoubtedly be heard from. Two Booth Racers, BR-1, supplied by the Aerial Engineering Corporation, have a designed speed of 216 miles per hour. One MB-7 (Thomas-Morse Monoplane) of tried and proven ability and having exceptional qualities of manoeuverability will be entered, and stands an excellent chance of winning the race.

In the Curtiss Marine Trophy Race, the Navy will have ten and possibly eleven contestants, which include two TRs, two TSs, and two Curtiss Triplanes, 18T type. Other entries in the Curtiss Race will be an HA Fighter, a Gallaudet D-4, an H-16, and a VE-9.

Intensive training of pilots is projected for the summer in preparation for the contests. They will be sent to Detroit in September and there continue training and familiarize themselves with the course.

The Detroit Races were originally scheduled for September, but recent advices from The Detroit Aviation Society postponed the dates of the Curtiss Race to October 7th and of the Pulitzer Race to October 12th.

The Baby Bomber

The air flivver has arrived. It is driven by a 17 horsepower motor taken from a popularly known motorcycle, which its builder used to ride.

This little plane was constructed at McCook Field by O. H. Snyder, one of the aeroplane experts. It is 16 feet in length and has a wing spread of 21 feet. It weighs less than 400 pounds and is the smallest thing that flies at McCook Field, where it is affectionately called the "Baby Bomber."

Lieutenant John A. MacReady, who holds the world's record for altitude, 42,800 feet, recently put the Baby Bomber through her paces in a two-hour flight. She did everything that a regulation plane can do. On a straightaway flight she made 62 miles an hour, was then throttled down to 21 miles an hour in landing and came to a dead stop in 40 feet. In taking the air she requires a runway of from 150 to 200 feet.

MacReady declares the little flier rides easy, is well proportioned and evenly balanced.

Snyder superintended the construction of the baby and built nearly all of it himself. Consumption of oil and gas is no greater than that required to send a motorcycle down the pike at 45 miles an hour.

Snyder believes that his little machines can be developed commercially and fill a need which is manifesting itself in aviation.

A Chain of Air Routes Across the United States

The latest project of the Airways Section, Office Chief of Air Service, is the formulation of a plan for the thorough investigation of practically 90 per cent of the proposed Airway System of the United States. Letters of instructions have already been sent out to the various Army Air Service flying fields, designating certain routes over which pilots from those fields should fly. Upon the completion of the initial investigation of the routes tentatively selected, and after a decision is reached as to the most advisable routes to fly over, the Army Air Service contemplates making arrangements for the inauguration of a regular bi-weekly aeroplane patrol over these routes, to enable pilots of the various fields to ascertain from time to time the condition of landing field facilities in the district allotted to them.

Pilots will be required to promptly report any field previously selected which has since been plowed up or otherwise rendered unsuitable for landing.

The object of establishing a system of air routes across the continent is to enable the Army Air Service to plan cross-country flights of a special nature, such as maneuvers, etc.

The establishment of this transcontinental airway system should prove of material aid to commercial flying and stimulate long-distance flights. Flights across the United States will not be of such a rare occurrence as at present, and it is possible, in view of the great saving of time, such flights will become popular, since they will curtail a journey of at least five days by train to two days at the most.

Transfer of Photographic School

The transfer of the Photographic School from Langley Field to Chanute Field, Rantoul, Illinois, marks the removal of what may be considered as one of the landmarks of Langley Field. The original school was established here in the Summer of 1917, soon after the organization of the Photographic Division of the Signal Corps. British advisory officers in the persons of Major Campbell and

The Baby Bomber designed and constructed by O. H. Snyder at McCook Field

Sgt. Major Haslett were among the first to arrive to teach the new use of photography from aircraft. These officers were also pioneers aerial photographers of the British Army.

At this time, Langley Field was just beginning to take form. The first Photographic School building was built by the students, many of them newly commissioned reserve officers. The personnel was at first quartered in what was known as the "old red barn," only the foundations of which may now be seen. The first class was graduated in the Fall of 1917, and some of the graduates were sent immediately overseas, others to flying fields and still others established schools of aerial photography at Post Field, Cornell University and Kodak Park, Rochester, N. Y. The latter was probably the largest school of photography ever operated, having had, at one time, as many as 800 students under instruction. The Cornell school a few months after its establishment, became the training center for photographic officers.

With the organization of other schools, the parent school became the school for aerial observers and continued as such until the Armistice. After the closing of the schools at Rochester and Cornell, the Air Service Photographic School, as it is now constituted, was re-established at Langley Field in the Summer of 1919.

The photographic laboratories and facilities of the Photographic School are probably unsurpassed by any similar school. Since its establishment three years ago, upward of fifty officers and one hundred and fifty enlisted men have been graduated.

Mexican Officers Visit Kelly Field

General Covarrubias, of the Military College of San Jacinto, Mexico, with his staff, visited Kelly Field on May 16th and was highly pleased with the aerial demonstration given at the field and much impressed with the possibilities of bombardment and attack aircraft in use against rebels and bandits in his country. The 2nd Photo Section took a number of pictures of the General's party and they were developed, printed and dried, labelled and presented to the party before they left the field. Four formations of five planes each passed before the reviewing stand in honor of the visitors.

Admiral Fullam Praises Bombardment Pilots

The morale of the Bombardment Group at Kelly Field went up another peg following Rear Admiral Fullam's address in San Antonio recently on the "Possibilities of Aviation," in which he praised the unparalleled feats of the bombardment personnel in the battleship sinking business last summer on the Atlantic coast and foretold some of the amazing possibilities of aerial bombardment. Of course, the members of the Group know all these things, but they like to hear others say them just the same.

Advanced Students at Kelly Field to Graduate

The present class of student officers and cadets has about finished their advanced bombardment training. There has been only one major crash during the present class. Cadet Halpin, on May 16th, attempted to make a forced landing in a small muddy field and wrecked the aeroplane. He escaped without serious injury.

Spraying New England Forest

Following previous experience in connection with the spraying of trees by aeroplane, plans have been formulated for spraying a section of the New England forest by this method. Captain R. A. Kinloch, Air Service, on duty with the 1st Squadron at Mitchell Field, L. I., New York, was detailed on this duty and departed for Boston, Mass. He investigated landing field facilities in the vicinity of the forest to be sprayed, and has been in consultation with the representative of the Department of Agriculture who was assigned to conduct the experiment.

Setting Up of Martin Bombers

The L. W. F. Engineering Corporation recently completed setting up and testing the first of the thirty-five Martin Bombers to apply on their contract for the Government. The first plane was flown by the test Pilot, Lieutenant Wade, of McCook Field to the Aero Marine Plant at Keyport, New Jersey, to be used as a model Work is now in progress by the Curtiss Corporation in setting up at Mitchel Field the first of the Martin Bombers which that corporation is building for the Army. This plane is now practically ready for test. It is understood that the Curtis Corporation will turn out one Bomber per week, all of these to be set up at Mitchel Field.

High Parachute Jump at Kelly Field

Master Sergeant Chester W. Kolinski, of the 90th Squadron, stationed at Kelly Field, San Antonio, Texas, made a successful parachute jump on May 24th from an altitude of 10,600 feet, so far the highest jump made by any member of the parachute school during the present course. The training pack chutes were used, and the ship was piloted by Lieutenant J. H. Doolittle. Both chutes functioned perfectly.

A Memorial at Love Field

At the entrance to Love Field, Dallas, Texas, there now stands a small granite monument, which was dedicated on May 30th last in memory of the twelve officers and cadets of the Army Air Service who made their last flight at that field. As Love Field is to be abandoned as a flying field and may soon lose its identity, this landmark was erected in their honor. The memorial bears the individual bronze name plates which formerly hung in the Officers' Club at that field.

The dedicatory services were very impressive, and hundreds of people were present to pay their silent respect to the memory of the departed flyers.

General William R. Smith, commander of the 36th Division and veteran of the World War, paid a high tribute to the momory of the men who gaves their lives during America's hour of stress. He declared that the progress of the aeroplane in the last war has shown conclusively that this method of warfare will continue to grow in importance, and that in event of future wars a still greater part will be played by the plucky and fearless men of the air. "They are honored dead," he said. "What they did in their struggles to master the air will be felt immeasurably as time flies on. Those martyrs who staked their lives in preparing for their needed service overseas did not die in vain. We owe them all honor and credit." As he stepped from the raised platform, he swept his cap from his head, which was the signal for the planes sent from Kelly Field, Ellington Field, Post Field and Love Field to take the air and circle the field. The planes rose gracefully and passing over the memorial shaft in rapid succession showered wild flowers upon the granite slab.

Other speakers were Herman Whisnant, who was an officer of the First Division and lost his leg in the Soissons campaign; Charles L. DeBow, chairman of the arrangements; Major Jed C. Adams, and Mrs. S. M. Fields, president of the Southern Memorial Society, who placed beautiful wreaths on the stone, with short impressive and touching remarks. Near the front of the shaft the emblem of the American Air Service was placed by the women of Love Field.

The officers and cadets whose name plates are on the monument are as follows: 1st Lieut. Rex Everett Field, 2nd Lieutenants Charles James Hyde, Parker Pruce, John Maxwell Widenham, Arthur Anthony Sego, Jr., Ralph Phelps Collier, Robinson E. Bidwell and Cadets Victor Leon Dennis, John William Albert Insinger, Ralph Eldon Stall and James Forester Dick.

This memorial was the idea of Lieutenant Marion G. Putnam and was his personal contribution to the memory of these men, many of them having been his friends.

General Patrick Visits Chanute Field

General Mason M. Patrick, Chief of Air Service, and his party, arrived at Chanute Field by aeroplane from Milwaukee on Wednesday, May 31st. The officers comprising the party were Major H. A. Dargue, Major P. Van Nostrand, Major Wm. C. McChord, Air Officer, 6th Corps Area; Capt. W. C. Ocker and Lieut. H. K. Ramey. General Patrick made a thorough inspection of the field and left on Friday, June 2nd. Major Van Nostrand remained at the field and accompanied Lieut. Frank M. Paul on a cross country trip to Iowa City, Iowa, and thence to Scott Field, Belleville, Ill. Lieut. R. R. Fox also made this trip, the purpose of which was to map an air route from Scott Field to Chanute Field and other points.

Aerial Ambulance

Under orders from the Department of War all flying fields in the United States are to be equipped with the new type of aero ambulance recently developed by the engineering division at Wilbur Wright Field, the largest aerial supply depot in the Army Air Service.

Ambulances are in various stages of construction at the present time and will be delivered to the fields as rapidly as they are finished.

The new type is known as the Curtiss J N 68. It is driven by a 180 horse power Hispano motor.

The litter carrier or stretcher compartment is located in the fuselage near the center. It is entered through a door in the side and extending across the top. It is connected with the physician's cockpit by means of portholes. The pilot's cockpit is right out in front.

The first model built has been successfully tested and given the official O. K. by the department.

Promoting the Establishment of Landing Fields

The trip recently made by Captain St. Clair Streett, Air Service, on duty in the Airways Section, Office Chief of Air Service, for the purpose of making a general survey of landing field facilities in the Eastern and Middle West sections of the United States, was productive of excellent results and, it is believed, will ultimately result in the establishment of a network of landing fields in these sections of the country which will go a long way in not only extending the field of commercial aviation but also in increasing the element of safety in flying.

In the various localities visited by Captain Streett the various commercial aeronautical concerns, as well as the municipal authorities, aero clubs, chambers of commerce, etc., were made acquainted with the efforts being made by the Army Air Service to encourage the growth of commercial aviation. Captain Streett states that at those places visited where commercial aviation concerns had been actively operating there prevailed a marked enthusiasm for aviation and a willingness to co-operate in any manner possible. It is his contention that it is the duty of every Army pilot to educate the public in the safe and sane usage of the aeroplane; with the fact that by its use one is enabled to cover long distances in a short space of time; that with the existence of adequate landing fields regular schedules of flight can be maintained without interruption, since with aviation equipment developed to its present degree of efficiency it is very seldom nowadays that it is found necessary to postpone flying on account of unfavorable weather conditions.

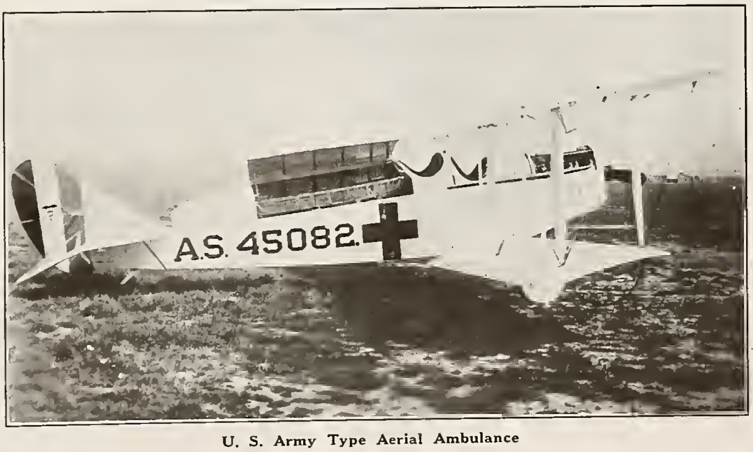
Aside from the primary purpose of the trip, that of boosting commercial aviation and securing all available information on landing field facilities, much useful data was obtained which will aid in the preparation of standard maps.

The itinerary of the trip was as follows: Moundsville, W. Va.; Columbus, Ohio; Dayton, Ohio; Indianapolis, Ind.; Louisville, Ky.; Camp Knox, Ky.; Kokomo, Ind.; Wabash, Ind.; Lafayette, Ind.; Rantoul, Ill.; Belleville, Ill.; St. Louis, Mo.; Fulton, Mo.; Kansas City, Mo.; Fort Leavenworth, Kan.; Lincoln, Neb.; Omaha, Neb.; Des Moines, Ia.; Cedar Rapids, Ia.; Iowa City, Ia.; Davenport, Ia.; Monmouth, Ill.; Chicago, Ill.; Milwaukee, Wis.; thence back to Dayton, Ohio; Toledo, Ohio; Camp Perry, Ohio; Cleveland, Ohio; Buffalo, N. Y.; Rochester, N. Y.; Syracuse, N. Y.; Utica, N. Y.; Schenectady, N. Y.; Albany, N Y.; Boston, Mass.; Hartford, Conn.; New York City; Baltimore, Md.; Washington, D. C.

Despite the fact that for five days during the trip between Dayton and Rochester rainy weather prevailed practically the whole time the plane was in the air, the whole trip was accomplished without incident. The plane used was a DH4B, which covered approximately 4,000 miles, the entire trip consuming five weeks.

Dr. S. M. Burka, of McCook Field, accompanied Captain Streett on the trip from Dayton to Omaha and return, while Lieutenant George W. Goddard was the passenger on the remainder of the journey back to Washington. Photographs were taken of all possible landing places whenever the weather permitted, and sketches were made of all fields visited.

Data was obtained from commercial aviation operating companies on their past operations and on their plans for the future. A number of cities visited either have adequate landing facilities or contemplate the immediate establishment of same, viz.: Louisville, Columbus, Kokomo, Wabash, St. Louis, Fulton, Kansas City, Lincoln, Omaha, Des Moines, Davenport, Monmouth, Chicago, Milwaukee, Buffalo, Rochester, Utica, Schenectady, Albany, Boston, Hartford and Baltimore. At the present time facilities are available at all of these cities where landings can be effected, and at every one of these cities the Chamber of Commerce and civic officials, as well as commercial aeronautical firms, invite Army and civilian pilots to use their facilities. Detailed information with regard to the landing facilities at the above-mentioned localities can be obtained from the Airways Section, Office Chief of Air Service, Washington, D. C.



U. S. Army Type Aerial Ambulance

REVIEW of WORLD AERONAUTICS

A British Cross-Channel Seaplane Serivce

An Air Ministry communiqué, issued on June 14th, makes a definite statement as to the cross-Channel seaplane undertaking which has for some time past been the subject of vague rumor. The scheme, which is to be operated by a company now in process of formation, probably with the title of "The British Marine Air Navigation Company," has been approved by the Air Ministry, and will be operated under the general terms of the subsidy scheme which was published in June, 1921.

Services are to be run by seaplane between Cherbourg and Southampton, and Le Havre and Southampton, the main object of the scheme being (a) to shorten the cross-Atlantic journey to London by picking up passengers at Cherbourg and bringing them to Southampton, and (b) to speed up the London-Paris service *via* Southampton and Le Havre by carrying passengers and mail by seaplane instead of by boat. Subsequently, it is proposed to operate a passenger and mail service between Southampton and the Channel Isles.

The services are to be carried out by aircraft designed and built by the Supermarine Aviation Works, Ltd., of Southampton. The scheme has the support of the London and South-Western Railway Company, who will actively co-operate in the matter of through bookings and railway connections, and the French railway companies concerned are to assist by providing suitable train connections for the through route to Paris.

The operating company will receive as subsidy 25 per cent of the gross earnings from passengers, goods and mail, plus a payment of £1 10s. per passenger and 1½d. per lb. of goods carried. These latter sums are half of the similar payments made on the London-Paris route.

This enterprise marks a very important step forward in the development of real commercial aviation, and everyone who is acquainted with the history of the Supermarine Aviation Works, Ltd., will hope that the venture will be as successful as it deserves to be, and will bring to them—as the constructors of the machine to be used—an adequate reward for their persistent faith in the value of marine aircraft for transport purposes.

French Aero Salon

December 15th next to January 2nd, 1923, is the date fixed for the next French Aero Salon—the eighth—to be held, as before, at the Grand Palais. The exact title has been changed to "Exposition Internationale de l'Aeronautique."

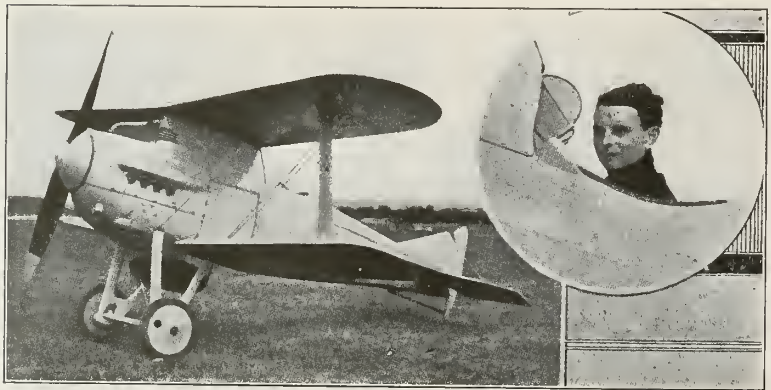
Italian Competition Entries

The results of the entries to the International Idro-Aviation Race of the Schneider Cup which closed on May 31st, according to the Italian National Aeronautical Federation, are as follows: *Italy*—5 machines—Two of the Macchi Firm, two of the Societa' Idrovolanti Alta Italia and one of the Pegua & Co. Among these three must be chosen. *France*—2 machines to be designated. *England*—2 machines to be designated.

The results of the entries for the Angelo Berardi Balloon Race are the following: *Italy*—8 ballons. *Belgium*—2 balloons.

The Berardi Balloon Race will take place June 4th in Milan.

The entries for the International Race for the Tyrrenean Cup and Grand Prize of Italy have been deferred until June 30th, 1922.



The Gloucestershire Mars I with 450 H.P. Napier Lion and Capt. James, who piloted the machine recently in England at 210 miles per hour

S. B. A. C. Officers

Mr. C. R. Fairey, M. B. E. (Chairman of the Fairey Aviation Co., Ltd.), has been elected Chairman of the Society of British Aircraft Constructors for the year 1922-23. Capt. P. D. Acland (Vickers, Ltd.) has been elected Vice-Chairman and Sqdn.-Comdr. James Bird (Supermarine Aviation Works, Ltd.) Hon. Treasurer.

Sir Henry White-Smith, C. B. E., the retiring Chairman, who has been Chairman of the Society since its formation in 1916, becomes Past-Chairman.

Twenty-Nine Days vs. Eight Days by Air

The Postmaster-General states that the air mail for Baghdad which was dispatched from London on May 18th reached Baghdad on May 26th. This was a particularly notable achievement, as the normal time occupied in transmission by the combined ordinary and air route is between 11 and 18 days, and by ordinary route all the way it is about 29 days.

Dutch Parcels Air-Post

The Postmaster-General announces that parcels addressed to any part of Holland may now be posted for conveyance from London to Rotterdam and Amsterdam by air and for express delivery by the Dutch Post Office. Parcels will be accepted at the Post Offices in London and in the larger provincial towns where air parcels for Paris and Brussels are already accepted. The scale of charges, inclusive of express delivery at the place of destination, will be as follows: For parcels weighing up to 3 lb., 4s.; 3-7 lb., 7s. 6d.; 7-11 lb., 10s. 6d. On parcels addressed "Poste Restante" the charges will be 6d. less.

There will be two dispatches by air each day. Parcels posted in London overnight, and, in the provinces, in time to be included in the night parcels mails to London, will normally be forwarded by air next morning and delivered in Rotterdam and Amsterdam the same evening, and in other parts of Holland by the second morning after posting. They should thus reach their destination two or three days earlier than if sent by the ordinary parcel service.

Another Polar Trip

Plans for Major Tryggve Gran's aeroplane flight across the North Pole from Spitzbergen are well under way. With his expedition he has been in Spitzbergen since May 29, and the company is now engaged in a survey of conditions in the neighborhood of Mourning Bay looking to the choice of a starting point.

With Major Gran are the relief pilot, Lieut. Richards, formerly of the British

Royal Air Force, who holds the record for the fasted flight from India to London; Thorlief Haug, a famous Norwegian skiing expert, and Jacob Tullin Thams, a navigator. They left Christiania May 20, without knowledge that Capt. Roald Amundson was then on his way to Nome to make ready for his projected flight across from Point Barrow, Alaska, in the opposite direction to that which they contemplate.

Aftenposten, the newspaper, is bearing the expense of the expedition, together with friends of Gran. Gran intentionally kept secret that he would try to cross the North Pole, to exclude competition.

Officially, the expedition's only determination is to find out whether aeroplanes can be useful to help seal hunters.

"Aeroplanes will quickly be able to find the seals' resting place and instruct hunting boats by wireless," Gran said before leaving Norway.

Major Tryggve Gran is one of the great adventurers of Europe. He comes of a noble Norwegian family and has been flying for the past twelve years. He was one of the first aviators to loop the loop, and in 1914, when a Lieutenant in the Norwegian Navy, made the first aeroplane flight across the North Sea.

One incident of this flight illustrates vividly the strides that have been made in aviation in recent years. In 1914 there was no such thing as an inclinometer, and knowing that he must fly through fog, Gran hung a lead plummet on a string before him in his cockpit. He had need of it, too, for in the course of his flight, and in the midst of the heaviest sort of a fog, he found the plummet hanging clear outside the cockpit. He was flying upside down!

Duirng the war Gran was a Major in the British Royal Force, commanding a bombing squadron in France. At the close of the war he became identified with the transatlantic projects, and went to Newfoundland as navigator of the Handley-Page Atlantic, commanded by Vice-Admiral Mark Kerr, which remained weatherbound at Harbor Grace while Hawker and Raynham adventured and failed, and while Alcock and Brown adventured and succeeded. The Atlantic was not ready for her attempt when the N-C boats got away from Trepassey to carry the American flag first across the sea by air.

Aviation is but one of the daring sports that Gran has espoused. Famous from boyhood for his skill on skis, he went with Scott to the Antartic in 1910 and was one of those who discovered the gallant explorer's body in 1912.

British Subsidy

In the course of a speech at the Annual Reunion of the Independent Air Force, in London, Captain Guest, Secretary of State for Air, stated briefly what the subsidy arrangement did for British constructors as follows:

(1) a direct payment of £3 per head per passenger that they carry; (2) machines on a hire purchase system at a total cost of three-quarters of their value; (3) change of machines at the companies' will; (4) meteorological services free; (5) use of aerodromes and sheds at a nominal charge; (6) Wireless and communication facilities gratis; (7) lighting services for night-flying purposes; and (8) benefits of Inspection and Research.

New Type Seaplane

The London correspondent of the New York *Herald* states that an aeroplane that according to its inventors promises to revolutionize flying soon will be submitted to practical test, according to information in aviation circles here. It is said to be unlike anything ever constructed before and is really a ship with wings. The utmost secrecy is maintained as to the details of its construction but it is said to mark the beginning of an aerial navy.

The plane is so constructed that it will not only float in calm waters, but it is claimed will be able to ride the roughest seas with the same security as an Atlantic liner. It is claimed that it will be equally airworthy. The hull is long, light and slender, without bulkheads. The elasticity of the hull which will make this possible is the outcome of many years' scientific research. The new machine will be a vast improvement on the present type of amphibians.

The experimental machine carries but seven persons, but designs for larger ones have already been made. The aeroplane will carry four or six engines and will be capable of traveling 100 miles an hour. It will be equipped with fog horns, anchors and riding lights. When not in the air it can travel on the water and thus accompany a battle fleet under all conditions.

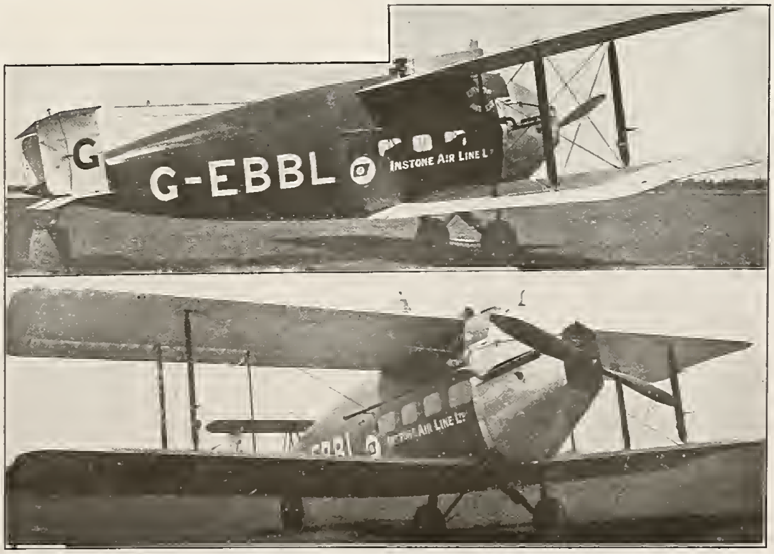
Machines designed chiefly for commercial service will be able to cross the Atlantic Ocean in less than forty-eight hours, it is claimed, carrying a heavy load.

New Dutch Company

The aeroplane manufacturing industry in the Netherlands is being extended by the establishment at Rotterdam of a new concern, to be known as the National Aircraft Manufacturing Co. (N. V. Nationale Vliegtuig Industrie). This enterprise is to be financed by Dutch capital exclusively and is to have a new factory built specially for aeroplane production.—*Commerce Reports.*

The Fokker Aeroplane Works at Veere, the Netherlands, are now executing an order for 10 "F. 111" passenger aeroplanes, each equipped with a 350 h. p. Rolls-Royce engine. These follow 4 similar machines already constructed and forwarded to Berlin as the equipment for a new aeroplane service between Konigsberg and Moscow, which is being established by the Russo-German Navigation Co. It is announced in the Dutch press that the Soviet Government has already executed a mail carrying contract with the new company.

In the first three months of the current year, 18 flying machines valued at $84,248 have been exported from the Netherlands, as compared with 7 machines valued at $45,000 in the corresponding period of 1921. Of the 18 machines exported this year, 10 have gone to Russia, 2 to the Dutch East Indies and 4 to Germany, the destination of the other two not being known.—*Commerce Reports.*



The Vickers "Vulcan," with 350 H.P. Rolls Royce engine, to be used by the Instone Air Line on Trans-Channel Services

FOREIGN TECHNICAL DIGEST

The New Two-Seater Junkers Monoplane

The new two-seater Junkers monoplane is built to the designs of Dr. Junkers of Dessau. Owing to the activities of the Aeronautical Commission of Control—which prohibited the building of aircraft in Germany up to May 5th—the machine had to be built in another country. Experimental work on this particular type has occupied some 15 months, and has included tests to discover a satisfactory engine, experiments with wings arranged at the bottom of the fuselage as in previous Junkers' monoplanes, and finally with the present arrangement.

Like the previous Junkers, the machine is of all-metal structure, using the characteristic corrugated thin sheet duralumin covering. The wing, of thick section, built on multiple tubular spars, is of 11 metres span and is built in one piece. It is attached to the top of the fuselage, and its leading edge is cut out to accommodate the pilot's head—very much as in the case of the Fokker F.III type.

The wing is also recessed on its under surface to accommodate the petrol tank—which is fixed actually to the top of the fuselage behind the pilot, but is enclosed by the wing when this is in position.

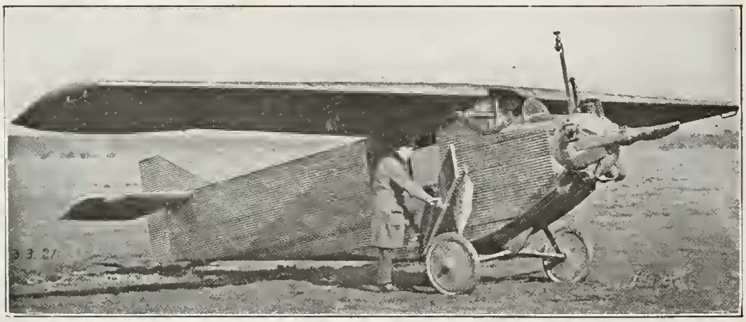
Behind the pilot and under the wing is a passenger cabin, large enough to accommodate two passengers, with a side entrance on the starboard side.

The undercarriage consists of two axles, hinged to a sort of rudimentary keel below the breast of the fuselage, a pair of thrust tubes, lying behind the axle, but also approximately horizontal, and a nearly vertical telescopic strut, fitted with shock absorbers fixed to the axle ends and to the fuselage side.

The engine is one of the 50 h. p. 5 cylinder radial air-cooled Siemens Halske type, fitted to the nose of the fuselage, and very thoroughly cowled in. The direct driven air-screw carries on its boss a forward projecting cylindrical nose of some length, which is meant to protect the engine from contact with the ground in case of the machine standing on its nose.

The machine is designed for high-speed special transport work—such as newspaper work of the type associated with the name of Mr. Cobham in this country. Normally with full tanks it carries one passenger and a fair amount of baggage. With reduced fuel or with little or no baggage two passengers may be carried.

No precise details of dimensions, weight, or performance are yet available, but it is hoped that these may be available shortly.



The New Two-Seater Junkers Monoplane

New Safety Devices for Aeroplanes

As we note from time to time improvements in construction tending towards greater safety in flying, the conviction is reached that the aeroplane has not yet emerged from its experimental stage and that, through the inventive genius of man, the aeroplane will eventually reach such a state of perfection as to eliminate any further cause on the part of the skeptical-minded to characterize flying as hazardous.

In England there have recently been introduced two new devices for the aeroplane, both of them having to do with landings, admittedly one of the most difficult features of the art of flying. One of these devices is a shock-absorbing type of under-carriage and the other is a self-sealing gasoline tank designed to withstand the stresses set up by gun fire and in crashing.

The first-named invention, the oleo-pneumatic under-carriage, which has been designed by A. V. Roe & Co., of London, England, manufacturers of the Avro "Viper," should prove of great value in reducing the risk of landing on bad ground, and should also be of value for early training and night flying purposes. The *Aeroplane,* London, gives the following description of this invention:

"This gear consists of two main undercarriage legs which are coupled at the base to the axle, the axle again being hinged by two horizontal tubes to the bases of two steel tube Vees situated in line with the front legs. The main legs carry a shock-absorbing device which consists of a combination of oil and rubber, and it is so designed that about half the travel of the telescopic leg is taken on the oil before the rubber is picked up. The detail of the oil valve is "interdit." The rubber shock absorber is in the form of separate rings, so that no trouble is entailed in replacing any particular broken or frayed portion.

On the ground the weight of the machine is carried by a combination of oil and rubber, and as the machine takes off the plunger sinks to its lower limit of travel. On landing the oil takes the first shock, so that by the time the rubber comes into play there is sufficient oil beneath the plunger to prevent bouncing. Mr. Hinkler (pilot of the Avro "Viper" testing this undercarriage) by changing his usual faultless method of landing, has been demonstrating how this undercarriage defies even the most ham-handed of pilots, by deliberately flattening out at various heights ranging up to 20 feet from the ground and then "pancaking," and also by landing at 80 m. p. h. with very little flattening out, but it seemed that no amount of effort on his part could induce the machine to bounce. It pulls up in a remarkable short run, and owing to the wide track of the wheels (6 feet) it is possible to navigate on the ground at almost any sane speed.

From the demonstration, which one witnessed, it would seem that the Avro "Viper" so equipped could land and get out of the smallest and roughest of fields possible without any trouble. As a training machine it might tend to give newly fledged pilots too much confidence and make them careless when passing into less robust machines, but for fully trained pilots it would seem almost ideal and guard the machine against almost any type of cross-country flying accident."

The Crash-proof gasoline tank, above mentioned, styled the "Silvertown Anti-fire Self-Sealing Petrol Tank," which was awarded the first prize in the British Air Ministry competition, calling for fuel tanks that will withstand machine gun fire and crashes without leakage of contents, and which tanks were subjected to the most rigid and exacting tests, is described by the same publication as follows:

"The metal shell or tank proper consists of thin-gauge metal plate butt welded together and of such a form as to permit of a large increase of capacity before bringing any tensile stresses to bear on the metal, with the result that the seams successfully withstand the stresses set up by gun fire and in crashing. This end is achieved by dishing inwards each side of the complete tank.

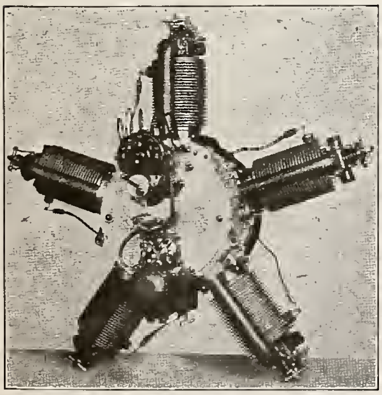
"The patent detachable cover is made of a high-grade rubber about a quarter of an inch thick, formed with an opening large enough to permit of the introduction of the shell. This opening is then closed with a closure piece of the same material suitably fastened in place, and it is claimed that this detachability renders the cover superior to any previous device. The cover can be manufactured and stored apart from the metal shell, and the latter can be removed from its cover and replaced at any time, without in any way causing damage to either.

"The judges appointed by the Air Council consider that the competition has resulted in the achievement of the objects for which it was instituted, and has produced a type of safety fuel tank which, although capable of improvement in several minor respects, is available for immediate introduction on Service and Civil aircraft, and which, for a slight increase of weight over and above that of the standard Service steel tank, gives almost complete immunity from fire, either in a crash or in action with enemy machines."

A New Low-Power German Radial Air-Cooled Aero Engine

LIMITED as Germany is to the use of engines not exceeding 60 h.p. for single-seater civilian aeroplanes, there is little doubt that the next two years, after which time the position is to be reconsidered, will see considerable progress made in the efficiency of German aircraft. The conditions imposed will force Germany, if she wishes to fly at all, to make such improvements in her aircraft as will enable it to do the work required with the limited power permitted. Thus, the restrictions may very easily turn out ultimately to be blessings in disguise. While other nations continue, in the main, to rely on power and more power, for increase in performance, load carrying or whatever purpose the particular design is being used for, Germany is prevented from taking this short cut, and will, of necessity, have to effect the necessary improvements by more efficient structural and aerodynamical design.

Whether in anticipation of a limit of 60 h.p. for single-seaters we cannot say, but the fact remains that, just about the time when the latest regulations came into force (May 5) the Siemens-Halske firm, of Siemensstadt, near Berlin, completed and tested a small radial air-cooled five-cylindered engine of approximately 60 h.p. In view of the fact that, up to the present, Germany has not produced many engines of this size, it may safely be assumed that the new Siemens-Halske engine is likely to become popular in Germany in the near future. The new engine has, we understand, been thoroughly tested, and is said to have given good results. We regret that no figures of weight, revolutions, consumption, etc., are available at the moment, but the following general description may not be without interest.

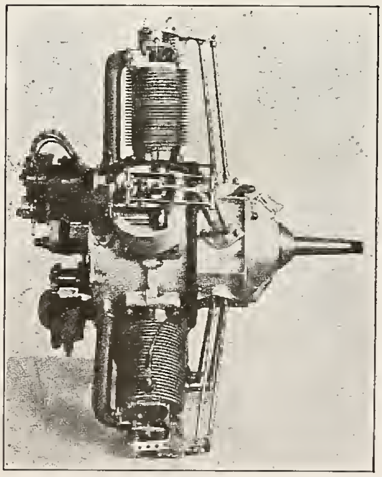

Front View

As will be seen from the accompanying photographs, the Siemens-Halske engine, with but five cylinders, is of very clean appearance, and should not, with suitable cowling, offer a great deal of air resistance. It is of the four-stroke type, with two valves to each cylinder. The bore is 100 mm., and the stroke 120 mm. The cylinders are of steel, with aluminium jackets having fins machined on them for cooling. The pistons are also aluminium, or aluminium alloy.

The aluminium crank-case is in two halves, and the flanged cylinder bases are bolted to it with four bolts each. As already mentioned, there are but two valves per cylinder. The inlet valve is operated by double rockers actuated by a push rod from the cam gear on the front of the engine. The exhaust valve is operated, also *via* push rods, by a single rocker arm, placed between the two rockers of the inlet valve. All rocker arms are carried in ball bearings. The valve stem guide of the exhaust valve is situated inside tubular T-piece, so that the exhaust gases escape through two openings. We believe that the manufacturers have designed a standard exhaust ring collector for this engine, so that from each exhaust valve cage, two short L-pipes run to the exhaust ring, which is placed *behind* the cylinders, and from which a single exhaust pipe projects upward in the typical German style. In the accompanying photographs this exhaust collector ring is not shown.

The rear portion of the crank-case contains the induction chamber, from which the various inlet valves are supplied through straight induction pipes bolted to the crank-case, and to the inlet valve cages. In the front portion of the crank-case are housed the cam discs and the thrust race. Needless to say, the camshaft, which is in two parts, runs in ball bearings. The high tension leads to the sparking plugs are housed in a ring on the front of the engine, and a single pipe carries all the leads from the magneto, which is mounted on a platform on the rear cover of the engine. The oil pump, which forces oil through the hollow crankshaft to the big ends, is also mounted on the rear cover of the crankcase. In its present form, the engine is provided with but one magneto, and there is only one sparking plug per cylinder, but we understand that, if desired, the manufacturers can supply the engine with complete dual ignition.

We hope that later some particulars relating to weight, r.p.m., fuel and oil consumption, compression ratio, etc., may become available, when we shall hope to publish them in AERIAL AGE.


Side View

ELEMENTARY AERONAUTICS and MODEL NOTES

Bird Flight Principles Compared to the Modern Aeroplanes

By F. F. Davis

THE study of bird flight resulted in men learning to fly, but have they not failed to use the great lesson of the bird's economy of power? And is the aeroplane, as we know it today, the best type of flying machine that can be built? To many, bird flight is a profound mystery, and some say it is impossible to learn much concerning it. Valuable information may be gained, however, by reading the works of the following: Etienne Jules Marey, Otto Lilienthal, F. W. Headley, James Bell Pettigrew, J. W. S. Rayleigh, Prof. S. P. Langley and many others. It will be found that some of these men have made long and careful studies of bird-flight and have used many instruments of their own invention for just that purpose.

By the use of electricity and photography, data has been gathered on the movement and power of birds' wings, close enough for practical purposes. It is found to be something like the following:

	Wing Span	*Supporting Area*	*Weight*	*Horse Power*
Condor	9-10 ft.	10 ft.	17 lb.	0.05
Turkey B'zard	6 ft.	5 ft.	5 lb.	0.015
Wild Goose .		2.7 ft.	9 lb.	0.026
Pigeon		0.7 ft.	1 lb.	0.012
Hu'ming Bird		0.3 in.	0.02 lb.	0.001

Enough Birds to Use One Horsepower

Wild Geese ..	346 lb.	101 sq. ft.	0.27 sq. ft. per lb.
Pigeons	83 lb.	58 sq. ft.	0.7 sq. ft. per lb.
Hu'ming Birds	15 lb.	26 sq. ft.	1.73 sq. ft. per lb.

By square feet is meant, *square feet of supporting surface.*

The best commercial monoplanes and biplanes early in 1922 did not carry in excess of twenty pounds per horsepower total weight, and the pay loads were near these figures:

Junker	3.54 lbs. per horsepower
Zeppelin Staaken ..	1.77 lbs. per horsepower
Bleriot Mammoth .	4.29 lbs. per horsepower
Fokker	4.77 lbs. per horsepower
Spad S-33	5.92 lbs. per horsepower

Aeroplane engines weigh from 1½ to more than 2 pounds per horsepower, and yet *two pounds of the muscles which move birds' wings give only a very small part of one horsepower.*

Aeroplane builders took the soaring or sailing bird for a model, but the flapping wing birds are far more economical in power expenditure. It is thought by many that in order to procure the same economy of power attributed to birds, it would be necessary to imitate every movement of the bird's wing, but in making machines to substitute the worth of the human hand (some far more complex than the flying machine we are thinking about), different movements are nearly always used to do the same work and it has been done faster and cheaper, too. Now the hand and arm perform more difficult and complicated movements than the wing of any bird.

For more than 25 years I have taken a deep interest in flying machines, having studied those that can fly to understand *why* they fly, and those that do not fly, to understand the reason for failure and to ascertain the good points in those failing to discover what features might be made use of. In 1919 I built a model flying machine on an entirely different principle from the aeroplane, which ran with a 2½ horsepower bicycle engine; it was geared back from the engine, but the engine was run up to its full speed. It is taken apart and is now in storage and I am anxious to build another as I now have more time, lighter materials and less to interfere with me while at work. I do not know of many men working on machines using this principle, but I am anxious to see some one build one well enough to show that it is far better than the aeroplane which has a propeller revolving cross-wise from the line of flight, giving a thrust of little more than three pounds per horsepower, with a great amount of wing surface that is a constant drag, that requires a specially prepared landing field and lands at a high rate of speed.

More people should study the flapping wing birds, swans, geese, ducks and many smaller birds, to appreciate the long distances they travel in a short time without depending on air currents.

It has been said that the reason birds fly with so little power is because they are so small, but study the figures given above comparing them with those stated in Prof. S. P. Langley's book "The Greatest Flying Creature" and this "reason" does not hold true.

The smaller the bird the greater the loss of power, and the more surface per pound required for its support. The swan weighs as much as 28 pounds and carries this weight far and fast on wings that are small for its weight. This is not done by any trick, but by a scientific principle of getting a fulcrum on the air, which is about 773 times lighter than water. The wing is a lever of the third class.

In making a machine to do the work of a hand or a wing or a leg, it is, of course, always better to use rotary motion rather than backward and forward motion in all parts that are suited to it and to use as few parts as will do the work in the right way with the least power.

It is important that our men of today use as a foundation the scientific knowledge that these pioneers have recorded in their books, and combine it with a knowledge of modern machinery and methods. It is not important to the world generally who hits upon the idea, but it is very important that some one does.

When the main principle of bird-flight is applied to transportation then civilization will take its next and greatest leap forward.

I wish to find others who are working along the same lines and would like to correspond with me.

Let each one do his own thinking and build his machine in his own way, but an exchange of ideas would be good, and if anyone is of the opinion that I may have stumbled on any little bit of knowledge in my reading that they have chanced to miss, let them write to me at 268 Willis Avenue, Bronx, New York City.

Hittle Tractor Hydro

THE Hittle tractor hydro record holder is of good design as its record of performance would indicate. Its record flight of 116 seconds has never been approached. The former record was only 29 seconds, making Mr. Hittle's flight all the more noteworthy.

Every possible method was used to cut down weight and resistance in every part of the model. This resulted in a total weight of only 1.75 ounce and an excellent glide of 8.75 to 1.

This model is a very stable flyer despite its light weight and large surface. It usually flies only 15 or 20 feet above the water but finishes up its flight with the motor practically all unwound.

Motor Base & Tail

A single white pine stick 5/16" deep and 45" long forms the motor-base. On the front the I. M. A. C. type of bearing for the propeller is bound and glued with a cellon base dope which is used on all joints. At the rear of the stick a piano wire hook for the rubber is attached.

The horizontal tail consists of a pie-shaped plane measuring 8" x 12" attached to the underside at the rear of the motor-base. The rudder, measuring 3½ to 3½ is attached at the rear of the rubber hook to the horizontal plane.

Wing

The wing is built of two white pine beams with ribs and tips of bamboo. A span of 43" and a chord of 5⅛" makes an area of 215 square inches. A slight dihedral is given the wing. The trailing edge is longer than the entering edge and the ribs are somewhat oblique in order to secure an even spacing.

The wing is fastened to the motor-base

with two bamboo clips which permit of adjustment. The wing is set at an angle of 4 degrees with the line of thrust. The wing tips are curved up slightly at the rear.

Floats

Two neat floats which take practically the whole weight of the machine are situated directly under the wing, just far enough to the rear of the center of gravity so that the model will not tip backwards. A single float of triangular section is just behind the propeller. The floats of bamboo construction are fastened to the frame with streamline bamboo struts.

The weight of the floats and struts complete with struts is only .23 oz.

Power Plant

The four-bladed propeller has a diameter of 10″ with a theoretical pitch of 14″. Two two-bladed propellers carved alike from ⅝″ thick planks are joined together. The blades are fairly narrow, tapering almost to a point at the tips.

Five strands of 3/16″ flat rubber drive the propeller at about 760 R. P. M. when in flight. The rubber was only given 1500 turns when it made its record flight and was wound less on the other trials, showing it to be capable of even longer flights.

The Lathrop Tractor Model

LATHROP'S tractor has an official record of 240 seconds, which is the best performance ever officially made by a rubber-driven model in this country. On the record flight the model disappeared from sight at the end of four minutes and, from what the observers reported, it seems logical that the machine went much longer. It was never found, although the surrounding territory was carefully searched.

There is nothing in the details of the machine which needs a lengthy dicussion here as the drawings clearly show the general construction principles. There was one of the standard type of cans used on the machine attached at the center of the motor-base. Three strands of 3/16″ flat rubber were used, giving the ten inch diameter twelve-inch pitch propellers a 90 second motor run. This run was sufficient to make the model climb out of sight on the several flights of the model before it was lost on the longest of all time. The motor base was about ⅜″ high.

The total weight of this wonderful model was 1⅛ ounces complete. Though this was a wonderful model it is *not impossible* to make one that will beat it! Mr. Lathrop worked long and hard on models before receiving the reward but it is some reward—the longest officially timed duration flight of any model aeroplane ever flown anywhere in the whole world and, for all the witnesses of the flight know, it may still be going!

Cook 45 Riser

THE Cook 45 riser is of the twin propeller, pusher type. The two propellers are 12 inches in diameter, carved from blanks ¾ inch thick. They are alike except that they are cut to turn in opposite directions, both revolving outward from the center on top. The blades have a width of 1″ and are 1/16″ thick. They are sandpapered, varnished, and finally balanced in order to ensure smooth running. Shafts of No. 16 piano wire are fastened in each and bent in a hook to receive the rubber.

The frame holding the rubber is made of two white pine strips 39″ long and ⅜″ x ⅛″ in cross section. In the front they are tapered, glued and bound with silk thread. A piece of No. 16 piano wire is bent to form two hooks for the rubber, and is bound on. These strips are separated by two "X's" and a straight piece of bamboo 3/16″ x 1/16″ in cross section, bound on with thread. The brackets for the propellers are made from No. 12 wire flattened and drilled for the shafts, glued and bound to the strips. Small copper or brass washers are used to reduce the friction.

The front plane measures 14″ x 3½″ and is made of 1/16″ round bamboo. The three ribs are given the curvature of about 3/16″ by bending the bamboo over a flame; any low flame such as a candle being satisfatory for this. The rear wing is surfaced on both top and bottom. The two wing spars are 3/16″ x 1/16″ set with the small edge up. They run the full length of the wing. The ribs are 1/16″ x ⅛″, double, one on top and one below for each complete rib. The edges are of 1/16″ square bamboo. The wing is covered on top and bottom with tissue paper. After covering the paper is treated with banana oil to shrink it.

The landing gear is made of No. 16 piano wire bent to the shape shown in the drawings. The wheels are cork, carved with a razor blade. They have a small piece of brass tubing for the axle bushing. All joints are soldered. The rear skid is also made of piano wire bent to shape and soldered.

One and one-half ounces of strip rubber is divided between the two motors and is hung loosely between the two hooks. In emergency, if strip rubber is not obtainable, long narrow rubber bands looped together will do the work. In the front end the rubber should be attached to "S" hooks which permit it to be detached and wound up with a converted eggbeater. When winding the rubber up, it should be stretched to 2½ or 3 times its normal length and then gradually shortened as it is wound. In this way many more winds can be safely given to the rubber.

Pond Indoor Model

THE Pond indoor model is a very slow and consistent flyer. At a contest in which this model made the flight of 170 seconds, the other two official flights were 160 and 164.6, making the average 30 seconds more than the former indoor world's record.

The builder of this model examined all of the available models around and selected parts on one and parts on another to copy for the present model. The best parts from each model were used. The resulting model won for the constructor a pair of racing ice skates.

Frame

The frame of the model is of balso wood. The front of the stick is strengthened by a protective coating of Ambroid, about ¾ of an inch back from the nose. This prevents the soft balso wood from being chipped and broken at the part of the motor-base which is most likely to be broken.

The "cans" and tail-pieces are fastened to the motor-base by means of Ambroid cement. No experience of parts so fastened of coming loose was encountered.

The frame barely stands the strain put on it. Two strands of ⅛″ flat rubber are used. This amount of rubber with a little slack was wound 1125 turns on the record flight.

Propeller

The 12″ oar used on this machine is also of balsa wood. It is very thin. The shaft was secured in place by a drop of Ambroid on both sides of the propeller. The tips of the propeller are rounded only slightly, as shown in the drawing.

Wings

The wing is of bamboo construction. The ribs, beams and tips are fastened together by butt joints, with Ambroid cement. The wing is not very flexible in flight, but it is very flexible to handle. The incidence of the wing is adjustable to some extent by a fairly deep "can" at the rear of the wing.

The tail-plane at the rear of the motor-base has two degrees of negative-incidence, which, with the bend in the motor-base, gives the model a rapid climb. The paper on the wing and tail surfaces is not doped. The wing tips are rounded to prevent the twisting of the wing due to any uneven pulling of the paper.

The tissue paper was selected from about about 20 sheets for light weight.

Weights

The total weight of this machine is .19 (nineteen hundredths) of one ounce. The weight is distributed as follows: Rubber motor .06; motor-base .05; propeller .03; wing .05 of an ounce.

The total area of the wing is 62 square inches. The loading per square foot is 144/62 x 19/100 = .441 ounces per square foot. With such a large wing and so little rubber, the speed of the model is just about the rate a person normally walks.

The skid shown in the drawing in dotted lines is one suitable for using in case an R. O. G. machine is desired.

Pond Tractor Model

THE tractor distance model designed by Bertram Pond is of standard design, with the exception of the hollow spar motor-base used. The record flight of 2,465 feet, accomplished on an unfavorable day, makes Mr. Pond's flight more noteworthy.

Even on a day when snow was on the ground a flight of 1,565 feet was made.

It is the light yet sturdy construction of the model which makes it independent of weather conditions. The total weight with six strands of 3/16" flat rubber is 1.47 oz. The glide ratio with the propeller off (but with the rubber on) is six to one.

Motor Base and Tail

A channeled spar with walls .025" to .028" thick with a cap of the same thickness glued on to it, forms the body of this machine. The stick is 3/16" x 7/16" in cross section and 33¼" long. (See detail drawing in the June 19th issue of AERIAL AGE). The channel was gouged out with hand tools and sandpapered to size, which was held to limits by the use of a micrometer. The cap was planed on a piece of plate glass for flatness, using a very thin cut. The cap was glued on with LePage's glue after the inside had been doped with banana oil.

The usual hook and bearing are fastened to the front and rear by Ambroid. Two 7/16" opening "cans" are used to prevent the motor-base from buckling.

The horizontal tail is formed of two bamboo strips with a split silk thread edging. The vertical member fits in the hollow of the spar, and it is of a shape to prevent warping.

The weight of the motor-base complete with fin is .35 ounce.

Wings

The wing is built up in the standard way with round tips to prevent warping. To counteract the efficiency loss accompanying a large dihedral or the loss of stability when the center of thrust is above the center of pressure (due to the depth of the motor spark) the front wing spar has a decided offset downwards sufficient to make the proper incidence and dihedral with both wing beams flat on the motor base. Also the center of pressure is raised without increasing the dihedral. The right side of the wing has more incidence than the left to take care of the torque of the propeller. The clips which hold the wing to the motor-base weigh .27 ounce.

Power Plant

The large 15" diameter 19½" pitch propeller is driven by six strands of rubber weighing .7 ounce. Propeller weight .15 ounce.

The rubber was given 825 winds on the record flight but will stand 1,200 as was proven later.

This model holds the unofficial Hand-Launched Distance and Duration Records with 6,300 feet and 522 seconds to its credit. It is a consistent flyer, having made 9 or 10 flights all over 1,500 feet. It usually climbs to a good altitude finishing up the flight in a very long but apparently steep glide, with the motor all unwound.

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(Concluded from page 399)

second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks indicating this line, after having completed the full course, approximately 240 miles.

5. WINNER:

The winner of first place in the race proper shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's license issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(*a*) Pilots must hold a straight course after starting until they have gone the distance to be specified and marked.

(*b*) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(*c*) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(*d*) Pilots shall pass all turning points in plain view of the observing officials stationed at each turning point and at an altitude of not over 500 feet.

(*e*) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the Field, and land in that part of the Field assigned for landing and in so doing shall not cross the course or finish line.

Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society, Inc., within twenty-four hours after the finish of the race.

9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

Event No. 5

Pulitzer Trophy, Saturday, September 16. Cash prizes: First prize, $1,200; second prize, $600; third prize, $200. Free-for-all race for high-speed aeroplanes.

1. CONDITIONS OF CONTEST:

(*a*) Factor of safety—Monoplanes, 7½ as loaded for start of race; biplanes, 6 as loaded for start of race.

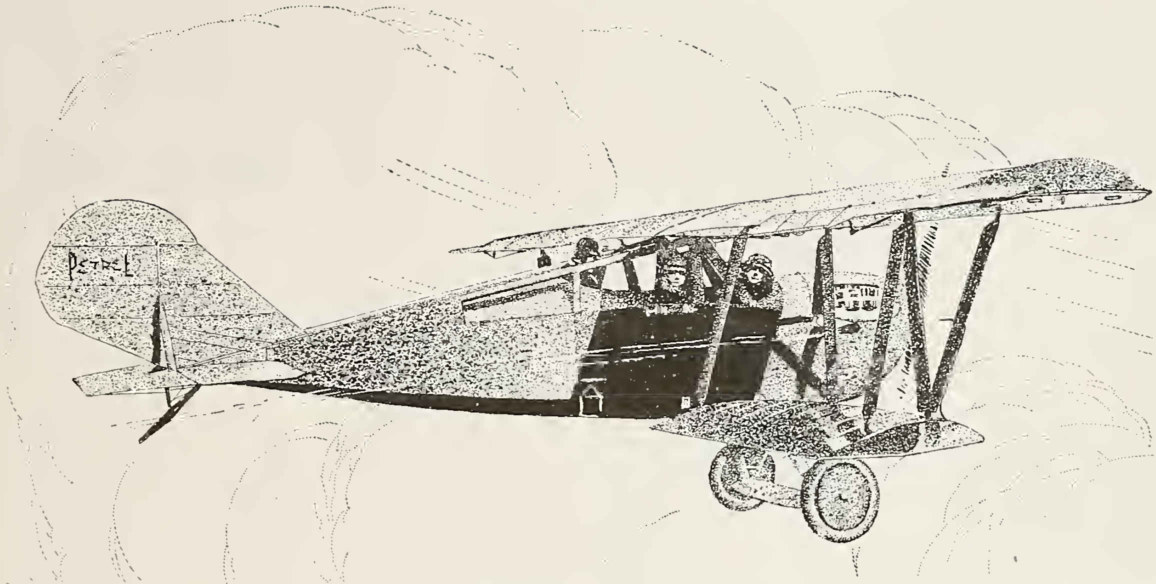
(*b*) Air speed greater than 140 miles per hour, as loaded for start of race.

(*c*) Landing speed not to exceed 75 miles per hour in still air. (See foot note).

(*d*) Visibility and maneuverability (land and air) which, in opinion of Contest Committee, is not a menace to the other contestants or spectators.

2. DISTANCE:

Approximately 160 miles, four times around a closed course of 40 miles, starting at Selfridge Field, thence west to captive balloon, thence to Packard Field and return to Selfridge Field.



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(*Continued from page* 408)

board of which General Shanks is president. Representations of the need of relief having been made by General Patrick, chief of the air service, it is hoped that some remedy will be recommended from that quarter requiring, of course, legislation. What this will be is not made known, but it is presumed that some plan will be adopted to place the air service personnel on a separate promotion list, after the manner of the medical corps, with possibly, promotion by length of service, although that is not essential, provided the advancement is made equitable as vacancies occur with the fair distribution of original air service officers to the field grades, from which they are now hopelessly excluded, or that the younger officers will be distributed on the present promotion list more equitably according to their actual length of service. This separation of air service officers from the promotion list would not, it is pointed out, interfere in the least with advancement in other branches, excepting in so far as such officers would benefit from air service vacancies. It would be justified, it is urged, by the fact that the casualties are so prevalent in time of peace. It is expected that same important announcement of interest and importance to air service officers will be shortly forthcoming in the report of the board engaged in a study of the promotion list. The impression prevails that, if the War Department approves of any recommendation of this character, there will be no difficulty in obtaining the necessary helpful and corrective legislation from Congress. A striking illustration of the disadvantage under which the air service is placed is afforded by the fact that of the officers now eligible for promotion in the various grades there are no air service officers among the 24 lieutenant-colonels, only one (Foulois) among the 30 majors, only one (Houghton) among the 67 captains, and 24 among the 152 first lieutenants. It is interesting to note that practically all of the 24 officers who are eligible for advancement from first lieutenant to captain are those who were originally commissioned as ground officers or transferred into the air service from other arms in which they were initially commissioned, this being due to the fact that the bulk of all the original flying officers are still a considerable distance from the junior officers in the list of first lieutenants for whom there are vacancies in the grade of captain.—*Army and Navy Register.*

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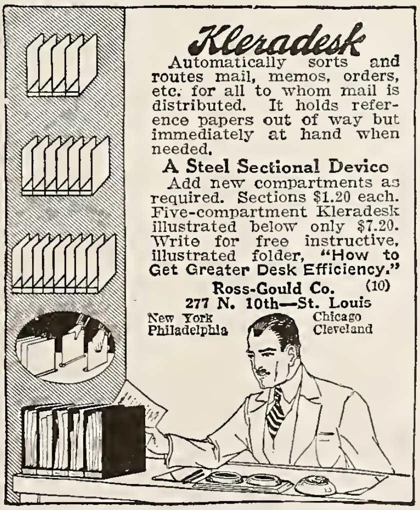

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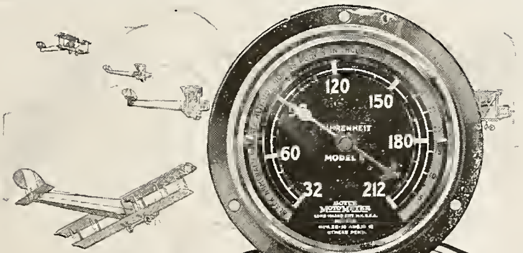

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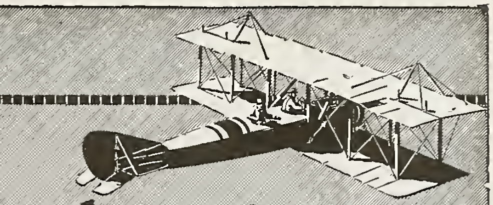

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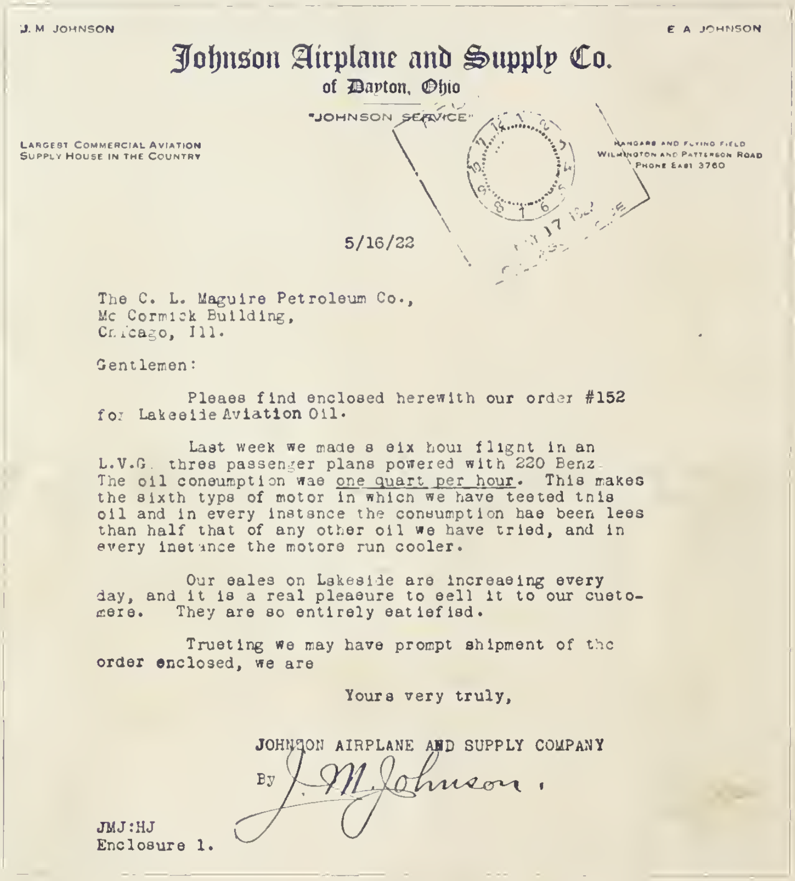

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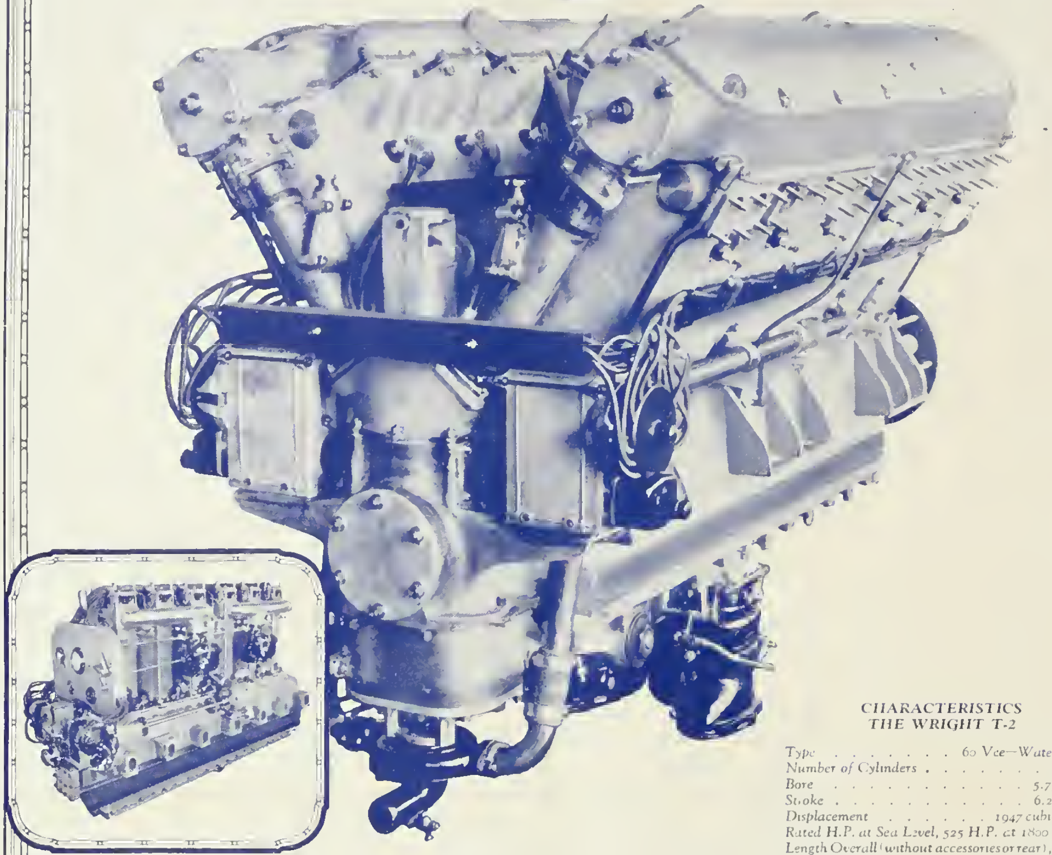

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Elementary Aeronautics and Model Notes 469

PUBLISHED MONTHLY BY THE AERIAL AGE COMPANY, Inc., 5942 GRAND CENTRAL TERMINAL, NEW YORK CITY
Subscriptions: Domestic, $3; Foreign, $5. Entered as second-class matter, March 25, 1915, at the Post Office at New York, under the Act of March 3rd, 1879.

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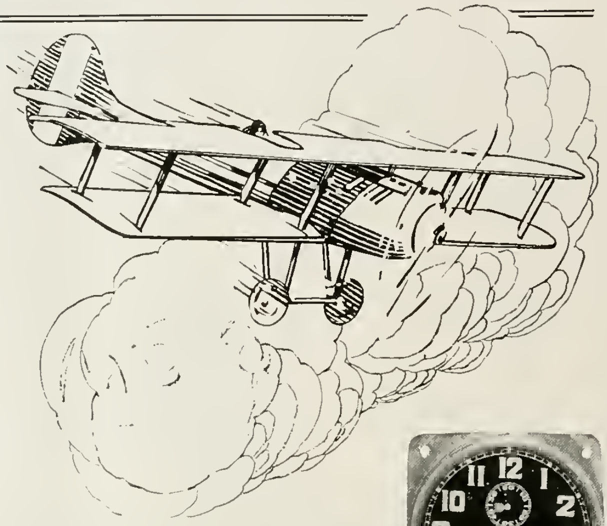

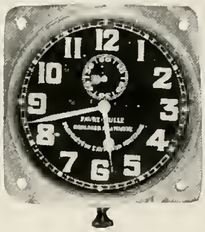

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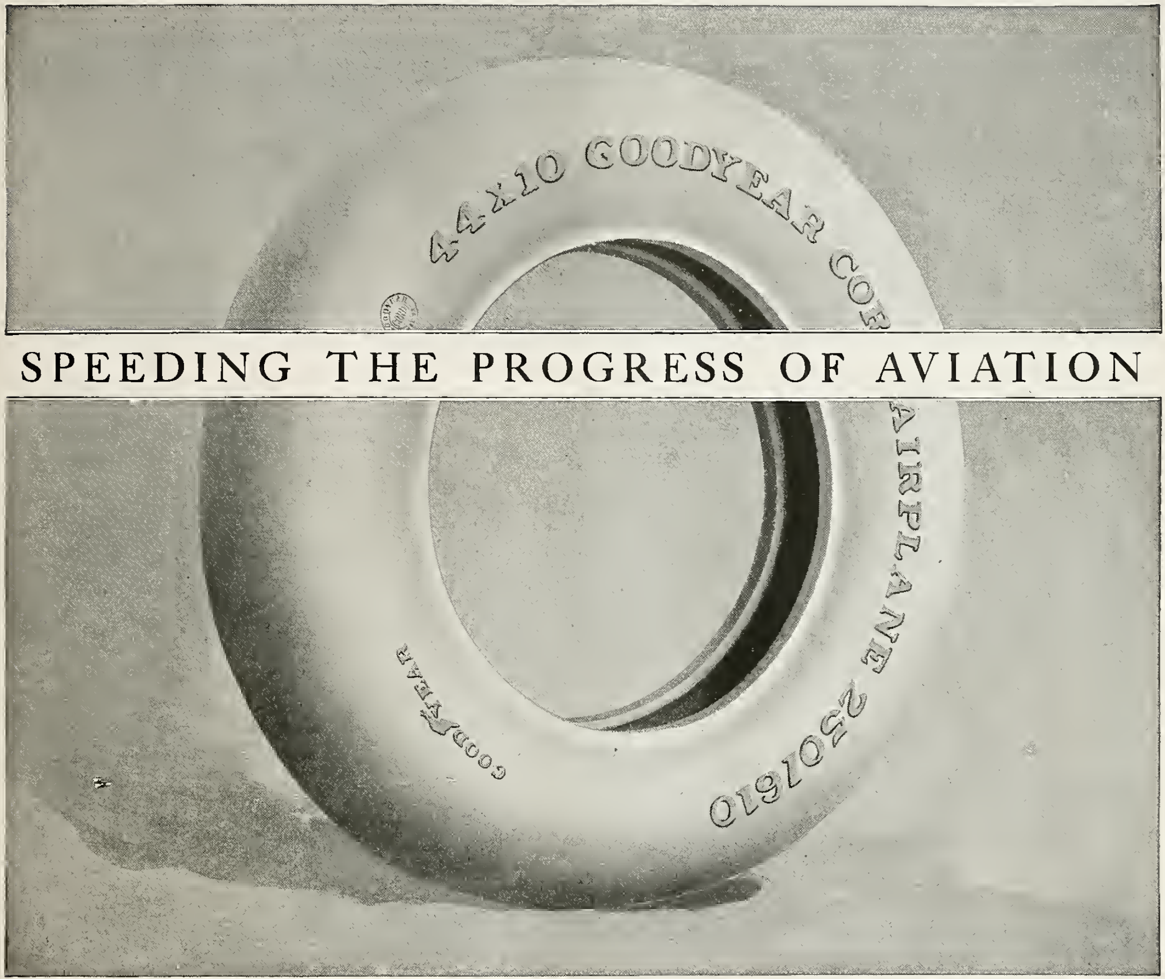

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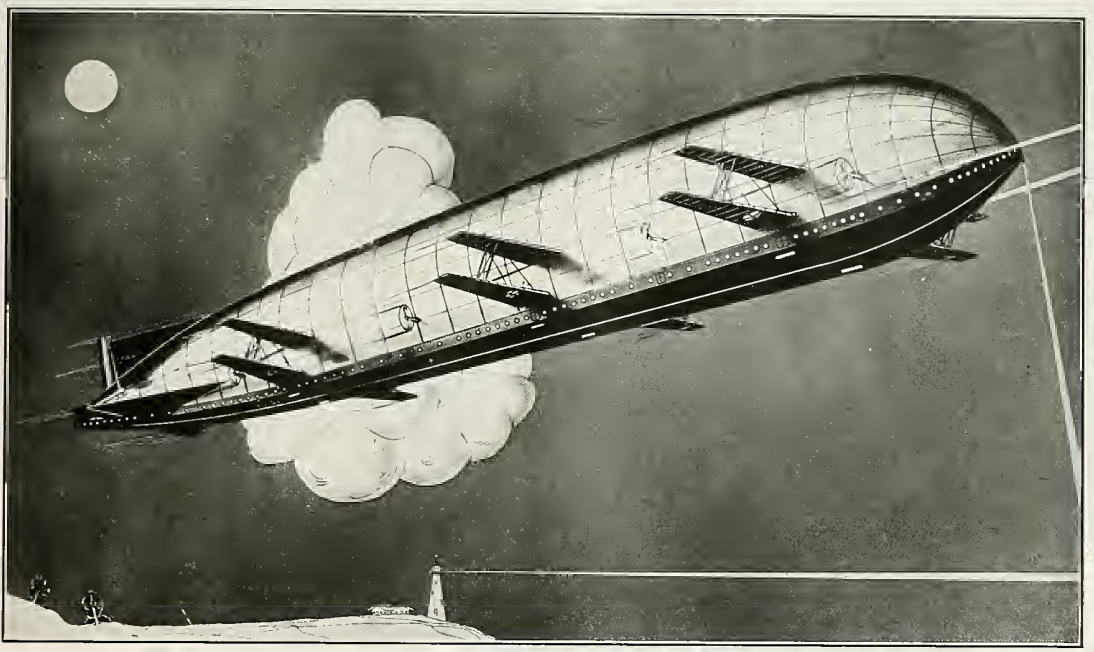

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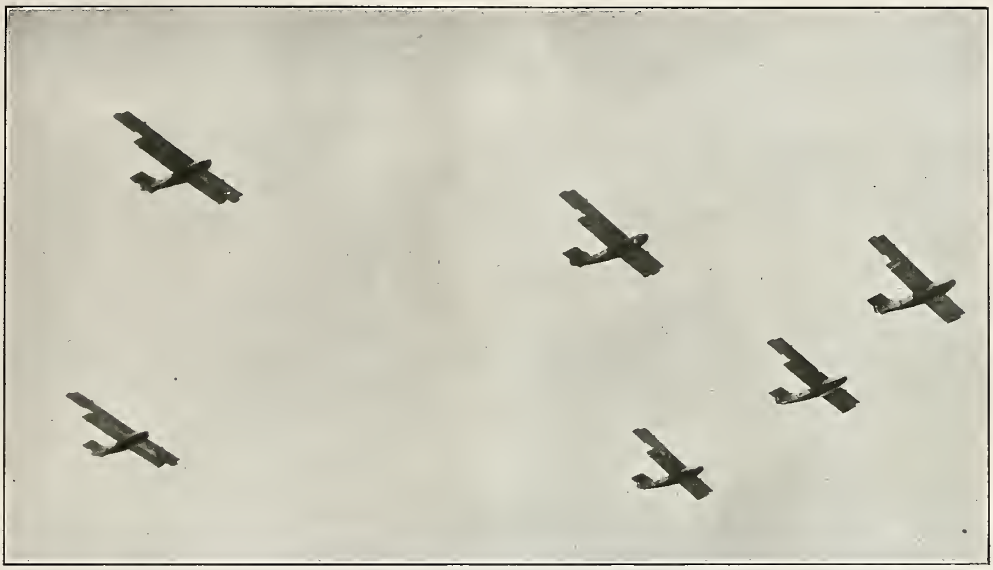


A Squadron of Navy Scouting Planes, each of which is equipped with radio, by means of which they can maintain constant communication with the battleships

Commercial Aviation Ready For Its Broadcast

By John Walker Harrington

THE era of air travel is close at hand. Its coming is foretold not so much in words, as between the lines of that comprehensive review of the progress of aviation in 1921, just issued under the auspices of the Aeronautical Chamber of Commerce. Indeed, the very existence of such a body as the Chamber is an augury that the flying art is ready to sweep over the Rubicon and make good its complete conquest of the air. The Year Book for 1922 furnishes facts and figures in which all of us may read the bright hopes of the future. What will be the magic word which will bring aviation into its appointed place? How shall it find, especially in these United States of America, that definite urge, equivalent to the establishment of broadcasting stations which transformed radio from the fad of the few into the marvel for the millions?

As was the case with wireless telephony, commercial or civilian aviation needs most of all the establishment of focal points throughout the country and the cooperation of government. Whether or not it would be helped by a subsidy is a moot question, but there can be no doubt that the aid of all authorities, Federal, state, and local would give to the art an impetus which would soon carry it into the landing fields of popular approval.

Aviation just now is at the point in the United States which was attained by steamboating just about a century ago. The wiseacres of 1822 were becoming convinced that although God had given a grade to the rivers which made them flow down hill, that it was not flying in the face of Providence for man to make a craft which would go against the current. Many feared to commit their lives to the new fangled craft but there were plenty of venturesome souls willing to take the chance. Then came the railroads, built in the face of great opposition, for there were those who thought anything faster than the trot of a horse was harmful to the constitution.

That the public has confidence in the skill of authorized air pilots in this country is revealed by the report that in 1921 there were carried 122,512 passengers by commercial aircraft, as compared with the 115,163 who availed themselves of aerial transport in the previous year. The mileage flown, as officially recorded was 2,907,245, which indicates a very healthy state of the art, for although it is a trifle less than the 3,136,550 of 1920, it included less free and more paid flights. If the activities of those birds of passage, the gypsy fliers, are taken into the account, the actual number of passengers who took the air may have been about 250,000 or a quarter of a million. This would bring, as estimated in the Year Book, a total mileage of approximately 6,250,000 miles.

The gypsy flier is not so unmixed an evil as the gypsy moth. His zeal has done a great deal to advertise aviation to the American people. When he drops down from Nowhere and induces Squire Bill Jones to take a jaunt into the ether, he does put aviation on the map. If he brings the Squire back safe and sound, he induces all the leading citizens of the vicinage to take a flyer and makes cloud hopping the rage. It is a lamentable fact that most of the casualties of the last year were due to the aerial tramps and to the doers of stunts. There were no lives lost through the operations of the duly organized companies, whose machines were in charge of efficient and conservative pilots. There has been a surprisingly large amount of passenger traffic, despite the phobias and the misgivings promoted by the alarmist accounts of accidents printed in the popular press. Many thousands of persons are now traveling by the ethereal routes as a mater of course, and they have done a great deal toward bringing aviation into common use. In some regions, the aeroplanes are going and coming like taxi cabs.

Private owners, such as Mr. Vincent Astor, use them as unconcernedly as though they were riding in their own automobiles. A group of friends of the young millionaire, the other day, made a flight from Port Washington to Newport in eighty minutes, and the newspaper accounts of the flight brought out the interesting circumstances of his own journeyings through the air to boat races and ball games. When the exact details of flights are more fully reported in the daily press, and the newsboys cease to cry "Turrible Accident" every time a pilot runs out of gasoline and has to volplane into a cornfield, the art of flying will be well on its way toward becoming one of our most popular outdoor sports.

What most is needed, in the opinion of those who would see the rapid advance of American aviation, is a through air route over which the public may be taken at night. Owing to the scarcity of terminals and the paucity of emergency landing fields, such a plan cannot be fully carried into execution. Suppose, though, that the trip could be made, as has been suggested, from New York to Chicago, without any overnight stops—one long and steady hop. When Mr, Robert Fulton took the first commercially successful steamboat up the Hudson, he had the Clermont tied up over night before the trip was much more than half done, for it would have seemed too much of a strain to have expected of a new mechanism, that it should go in the dark as well as in the light of the sun. When suitable lights and marks and fields can be made ready, however, there is every reason to believe that aviation will get much of that popular urge which is so necessary to putting it on a broad commercial basis.

The way certainly has been blazed for the art by President Harding by his advocacy of the Aerial Code, which will be a great encouragement to Civilian flying. The bill now pending before the House which would regulate the operation of aircraft in state and interstate commerce, and establish a Bureau of Civilian Aeronautics in the Department of Commerce will be an efficient guide to the new order. A huge aerial highway, like the Lincoln Highway of the land, over which could course the argosies of peace letting down their passengers as well as their "golden bales" would do much toward establishing air travel on a parity with vehicular transportation on the land. Just as the efforts to give to this country well ballasted and macadamized roads, has stimulated the production of automobiles, so the marking out of some great aerial trunk line, to be followed with ease and safety by night and day, will do much toward giving to aviation its popular broadcast.

Long distance aviation, although there have been some phenomenally sustained flights, is still young, for the 1922 Year Book tells us that the average duration of the 130,736 flights made in 1921 was only twenty-one minutes. There must have been some very short essays of the bright empyrean, indeed mere glimpses of cloudland, to bring down the average so low. The lack of facilities is a factor in this, for although there are 146 terminals now as compared with the 128 of 1920, air travel is still much handicapped for the lack of ports. When commercial aviation comes into its own, aircraft should be able to keep much busier.

The 1200 craft now in commission have made little more than a hundred and ten flights a year each although their number is twenty percent higher than that given in the 1920 census.

Passenger rates are coming down, by the way, as the average charge for the short flights in this country is now $9, whereas the 1920 rate was $12.50. The usual rate per mile charged for the inter-city flights is now 55 cents, a decrease of ten cents from the fare of the previous year.

Aside from the brief excursions skyward, commercial aviation even now is providing some well sustained travel programmes. The Aeromarine Company for the sum of $75, one way, transfers passengers from Key West to Havana or vice versa. The schedule provides for a flight of an hour and a quarter and, it is advertised, that the passengers save seven and a half hours, as compared with the length of time which would be required on the water trip. The same company has also been successfully operating a line of aeroplanes between New York and Atlantic City.

The Curtiss Northwest Aeroplane Company is running its aerial cruisers from time to time from various points to Minneapolis and St. Paul. Out on the Pacific Coast Walter T. Varney is furnishing air transit to the California sightseers.

One of the most significant developments of commercial aviation is the transportation of both freight

G. Elias & Bros. Commercial Type Aeroplane, built in Buffalo, N. Y.

Jackson Park Yacht Club, Chicago, Ill. Photographed from a Ralph C. Diggins plane

and passengers in Larsen monoplanes from Edmonton into the Canadian oilfields. Prospectors and promoters save many days by this course, as they otherwise would have a long and tedious way by land and water. The Larsen interests have been doing a remarkable service all over the United States in giving educational flights and in converting thousands of persons to the higher life.

The epigram that the automobile industry is merely an infant, and that commercial aviation is unborn, is hardly justified by such records as are here cited. If civilian air travel is still to see the light, it is certainly a very live and kicking embryo, and even now it compares favorably in many ways with similar flying in Europe.

What with government aid, and the earnest cooperation of the large manufacturers, which is still more important, perhaps, European public flying is so far advanced that the air excursions are referred to as ordinary methods of transportation for tourists. Americans returning to this country start a thrill or so, by telling of their adventure in crossing the English Channel on their way from London to Paris, but Englishmen and Frenchmen regard all such expeditions as part of life. Dining at sunset at the Savoy and supping at the Ritz are pastimes for romantic bridal couples, and before long they will be undertaken in staid and sober fashion by other "respectable married people with umbrellas," as Stevenson used to say of the volcano visitors.

French commercial aviation is certainly proceeding apace, for the cables bring the news that this last June from the le Bouget air port in Paris alone, 544 planes arrived or departed. They transported in that period 2,058 passengers, 56,360 kilograms (about 120,000 pounds) of merchandise, and 472 kilograms of postal matter.

British commercial aviation has also been on the quivive, for it is reported that up to September of last year 671 planes had been in commission going and coming from the Continent with 4,006 passengers. In England there were 31,853 passengers carried.

The business of transportation of freight and express matter is well under way on the other side of the Atlantic, for England sent away air exports valued at 110,400 pounds, while her imports from beyond the choppy channel were 206,357 pounds. Costly hats, rich perfumes, small works of art, notably Chinese porcelains and Old Masters, are often sent from Paris to London by air.

Germany for many years has had established air transportation facilities and now has ten aerial trunk routes. Flyings beyond the Rhine proceed in regular schedule and passengers and freight are conveyed quickly from place to place.

Although the layman does not yet realize it, there has already developed in this country something of an "Overland" freight service. The editor of the Year Book tells us that American aircraft in 1921 carried 123,227 pounds of goods, or about three times the amount transported by air in 1920, which was 41,390 pounds. Much of this merchandise, it is true, was carried for advertising purposes or for the introduction of products. In a practical way and as a matter of routine, however, many large wholesale drug houses are shipping valuable medicines, such as toxins, in this way, while silk dealers and jewelers often resort to the air routes for quick delivery of their wares. In regions where civilization is not always on guard, such as among the gold and oil prospectors, there is a dearth of soap which is often met by the speedy aeroplane.

The managers of the large express companies in the United States have already put themselves on record as favoring the carrying of packages of value by aerial routes. They believe that the development of the Air Mail Service of the United States, which is doing well despite many drawbacks, will bring about a steady demand for transportation of compact and valuable goods "via Cloudland." The details of aerial freight transport are being worked out so closely these days that it will only be a quesion of time before railroad and express companies will recognize in aircraft companies formidable competitors.

The flying machine may be made to serve the financial interests in all directions, especially in the transportation of checks, drafts, and other business papers, and thus it will become the ally of the Clearing House and the Federal Reserve Bank. Finance and commerce are vitalized by dispatch and they are willing to pay the cost of creating it. Commercial aviation will ascend still more toward the star of success, as its appliances are more and more adapted for the traffics and discoveries of peace. Much genius and patience was devoted to the building of planes for war purposes. Lightness of construction and speed were important requirements in the conflict and the military aviator was not so much concerned about his own safety as the prospect of bringing down an enemy. The open cockpits and the long, low rakish bodies are essential to military operations, but now the trend is toward craft which will be comfortable for the passengers. Then will come the staid folks who won't even put on several thicknesses of jackets, and goggles, but will sit in the cabin behind the mica windows, in ordinary attire and sip lemonades or anything else beyond the three-mile limit, and read the magazines while the world goes by underneath them. These passengers of the morrow must have all kinds of conveniences and they will forget about the risks, and only know where they are, probably when they feel the machinery throbbing only feebly and are aware of the downward drag.

There are the genius and the inventive skill in the United States which will make possible the building of aircraft which will meet every requirement as passenger carriers and cargo bearers. The difficulties of air travel, and for that matter, those of safely piloting the planes, have been much exaggerated. With a public which has a sportsmanlike quality and with cool and experienced pilots, the ordinary problems of aerial traffic can be readily solved.

Now is the time, then, for Congress to give the word to go ahead, by adopting without delay the Aerial Code. If this be followed by a consistent and aggressive policy of development in the naval and military aviation, and all efforts be used to make the Air Mail Service a notable success, commercial flying will win more and more of popular favor. What is needed at the present time is concentrated effort on the lines of demonstration. If the large aeroplane manufacturers will help in the worthy cause of spreading the gospel of safety by establishing or promoting through air routes, the public will have daily assurances that aviation is a sane and riskless pastime, within just the same limits, at least, as railroading and automobiling are not perilous. Foreign aircraft corporations have been so wise and far seeing as to aid in this policy, and thus cooperate with the various governments.

The speedy enactment of an Aerial Code by Congress would make possible a general national campaign in the interests of commercial aviation, as it would clear the air of many vexed problems. Then it would be possible to gain the full cooperation of the authorities, national, state and local, and of the manufacturers and various air transportation companies, in the development of air ports, terminals, emergency landing fields, and all those facilities needful for the symmetrical and orderly development of the Icarian art.

Vital Importance of the Detroit Races

By Harold E. Hartney

IT was not many years ago that a small town in Ohio passed an ordinance prohibiting the railroads from laying tracks through the municipality. The village solons had decided that the railroads traveling at the inconceivable speed of fifteen miles an hour would be a menace to human life and property. Times have changed, to be sure. The Twentieth Century Limited and the highly developed motor car have accustomed us to forty, fifty and on occasion sixty miles an hour. For several years now it has been a fast life. But when the thousands gather at Detroit, Michigan, in October to witness the National Aeroplane Races they will, without question, see such speed as to convince them that another and superlatively fast era is dawning. As this is written there are more than fifty entries for the various events sponsored by the Detroit Aviation Society, which has been working for several months, actually working, to the end that this year's great races shall be known as the greatest flying meet ever held, in America or anywhere else.

On the last day of the races, which commence with the Curtiss Marine Trophy Race on October 7th, and conclude with the Pulitzer Trophy Race, the crowds will witness the most significant and vitally important contest ever staged on this hemisphere, and possibly, many believe, in Europe. There are twenty-three confirmed entries for the Pulitzer race alone and still others to come in before the list is closed. All the machines bear the technical description of pursuit planes. A majority vary in design, motor power and construction. Some are of metal, others of wood, and others of wood and fabric. Several will have 600 horsepower motors, Packard type, which General Mitchell recently pronounced one of the most efficient aeroplane engines yet developed. He added that if there had been any bugs in the Packard 600 (and no motor was ever produced that did not develop bugs in its initial stages), said bugs have been exterminated by the combined efforts of the Packard engineers and the scientists working with the U. S. Army Air Service. Great things are hoped for the Packard. Then there are the Curtiss and Wright motors, both of which possess excellent recrods for efficiency. The Curtiss and Wright motors showed their teeth at last year's Pulitzer; while the Packard, then in an experimental state, won out in the 1920 classic. The motor contest will be worth watching.

(*Concluded on page* 474)

Building Our Cities in the Country

By R. R. Blythe, R. A. F.

COMMERCIAL aircraft in America traveled 6,500,000 miles during 1921. Six million miles in the air in one year! There can be drawn only one conclusion from this statement and that is that where we have now flown a distance sufficient to convince the public of practicability of aviation, the future lies ahead in an unlimited broad expanse of development.

Our national yearly average is something like 9,000 deaths in automobile accidents compared with only fifty-five deaths caused by aircraft. Yet the great majority of the American public today will point out that flying is unsafe. The reason of this lies directly in the fact that our newspapers have impressed upon the public at every opportunity by featuring aeroplane crashes that there is still a grave danger in flying.

Major B. L. Smith, general manager of the Aeromarine Airways, Inc., stated in his address before the Aeronautic Executives that the report in the Sunday newspapers of the crash of the London to Paris air liner decreased the gross income from passenger flights by 100 per cent over the previous Sunday's income.

Yet this great commercial air transportation company now operating in the United States has not had a fatal accident to a passenger on its flying boats in two years' flying history.

In fact, one of the most encouraging signs that the day of profitable and reliable air lines—linking our cities with scheduled passenger, freight and mail service—may not be far distant, is to be found in the report recently submitted to the Director of Naval Aviation by this company, owning the Aeromarine passenger planes. It operates a daily mail and passenger service between Key West and Havana, Cuba, according to the report; also between Miami, Fla., and Bimini, and between Miami and Key West. Its fleet consists of six eleven-passenger converted navy flying cruisers and six five-passenger flying boats. In addition to scheduled service, the company engages in special charter flights.

The Aeromarine flying boats made 735 complete flights, the report points out, in the four months from November 15, 1921, to March 15, 1922, with a record of 640 hours flown, and 268,538 passenger miles. Of these flights, 171 were on the 100-mile Key West-Havana route, while the charter and miscellaneous flights totaled 359.

During these operations, not a passenger nor employe was injured, and only five boats were forced to return to their bases. The schedules were maintained throughout, with the exception of these five flights, according to the report.

In two years of operation, the report discloses, the company's flying boats in passenger service have flown a distance of more than 150,000 miles, and have carried 10,700 passengers without a mishap.

Our own Air Mail carries its message of safety and reliability on all the trips started between New York and San Francisco for a period of six months there only developed one half of one per cent mechanical troubles that caused forced landings. During this period not a singe pilot was injured. Plane No. 189, which is in service between New York and Bellefonte, Pa., has been flown over four hundred hours, or about forty thousand miles and has not yet had a mechanical forced landing.

With these records of safe operation why does not the public utilize this mode of transportation which can carry passengers or freight in half the time consumed at the present time? The answer is apparent, though many have evaded facing the inevitable—the establishing of organized air ports sufficiently available from the centers of commerce.

The distance of these air depots from the centers of commerce is perhaps one of the greatest drawbacks to the development of commercial aviation. Considering New York as a point in question, it is safe to state that not over ten metropolitan mercantile companies have considered using aircraft for transport, and it is equally safe to assert that the inaccessibility of air ports the greatest factor.

Let us therefore consider a main Grand Central Air Terminal at Battery Park in the Borough of Manhattan. Seaplanes running up to especially constructed docks taking on passengers and freight in comfort—the luxurious F-5-L converted Aeromarine Seaplanes with the splendor of comfort and security—embracing from the heart of New York City four or more scheduled flights per day to Atlantic City, Boston and neighboring seaport cities. Every hour large deeply upholstered D.H. 34's of latest type and construction, graceful Fokkers and Junkers monoplanes would take off across the landing field of Battery Park in regulated order, flying to all inland cities with burdens of passengers and freight. How long would it take for the most conservative firm to realize the possibilities of beating a competitor to a market in half the time that it would take a train to deliver the same goods? Bring aviation to the business centers and you've brought it to the hearts of the public.

Aeronautics will revolutionize the world. This change will not come about in a violent or sudden burst but slowly and steadily as the public realize the greatest of all modes of travel and its uses. All life has depended upon transportation; in the early days the settlers built their homes on the river banks; waterways, railroads and motor roads today form the arteries of all countries.

Many and manifold as are the advantages and attractions offered by the cities, numerous also are its disadvantages and hardships. We cannot look at a city today without seeing its slums and tenements as well as its parks and boulevards.

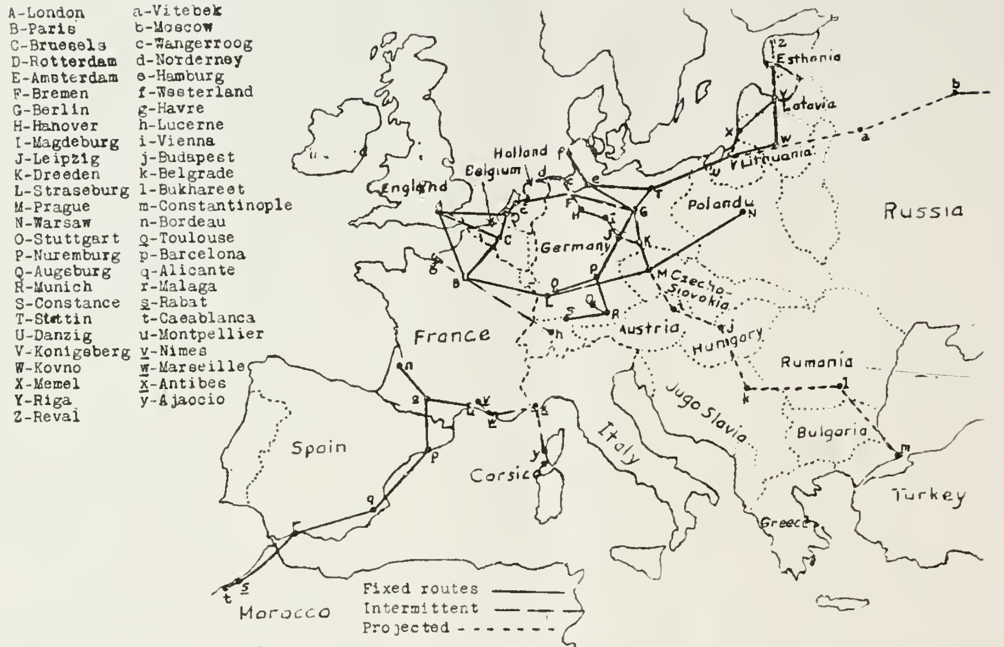
It goes without saying that thousands of city children grow to maturity under conditions that are as far from inspirational as are those that have hampered the natural development of many a country-bred boy and girl.

Our present system is not sufficiently flexible to meet satisfactorily the variable conditions presented by the human element. And therein lies the overwhelming disadvantage of the city. Expansion beyond a certain point results only in congestion, and this in its various phases lessens the values otherwise growing out of centralization.

In comparison with this we have in America great expanses of uninhabited land which is sufficiently adjacent to alleviate every crowded family in New York. Sweet fertile soil and clean, wholesome air and yet we are crowded to the close quarters of apartments with the noise and smoke, living and breathing, over three million people on Manhattan Island.

The city of the future will be like our congested business sections at night—useful only for centralizing our business efforts and segregating the contact from the home.

Commuting by air will bring in the millions for the day's work and will return them to the pleasant home with spacious ground, where the trout stream bubbles close by and in the early twilight the birds twitter each other to sleep. The commuting will be swift, clean and pleasant, instead of rushing like moles into the subways and trains, where the masses push and struggle, breathing the foul subterranean air in the mad rush of the eight forty-five and the five-fifteen.



Existing and proposed passenger airplane routes in Europe.

European Air Travel in 1922

By Edward P. Warner*

Of that horde of American tourists that are already crowding every ship that swings down New York Harbor from the Battery or out past Boston Light, there are, no doubt, many who are planning, whether openly or secretly, to make for themselves a real trial of air transport before they return to the United States. The trip from London to Paris by air has become so much a commonplace that it is included in the itineraries of carefully shielded parties of schoolgirls, and one seldom hears danger offered as an excuse for not taking that journey at the present time. The expense is still the principal drawback to a more extended use of that and other air routes, and it is admitted by those connected with the administration of the air lines that a large part of the traffic is made up of American tourists.

The general scope of the routes is shown by the accompanying map, on which the designation "regularly operating" is used for lines running at least three times a week in each direction. The routes will be observed to fall into four general classes, those radiating from London, the lines of Southern France and the Iberian peninsula, those of Germany and northeastern Europe, and the French lines running to the east and northeast from Paris.

The failure to establish more extensive direct connection between the German and French lines is the outgrowth of political feeling and of the provisions of the International Air Navigation Convention, in accordance with which communication can only be made through neutral countries until such time as Germany shall be admitted to the League of Nations and allowed to ratify the convention. The failure to link up the lines of northern and southern France is a little more surprising, but can be attributed primarily to the excellence of the terrestrial transportation. A train leaving Paris a few minutes before 8 in the evening arrives at Toulouse at a few minutes after 8 in the morning, in plenty of time to connect with the departure of the aeroplane for northern Africa. It is not economically sound at the present time to attempt to run air lines over routes already well served by the railroads if the distance between the termini of the line is such as to make an easy night's journey by through train. From 300 to 600 miles is the worst possible distance for an overland air route, since that is the distance over which travel by night presents the greatest advantages.

Turning to the detail consideration of the routes shown on the map, there are five distinct companies operating between Paris and London, and some regularly scheduled journey over that route starts at nearly every hour during the day. The voyager has his choice of a large range of types of vehicles, ranging from the war machine rebuilt to carry four passengers up to the luxurious twin-engined commercial aeroplanes carrying 10 or more and used by several of the companies. The time required for the trip depends somewhat on the type of aeroplane used, but is normally from two and a half to three hours. Between London and Brussels and London and Amsterdam (with a stop at Rotterdam), also, there are daily services, the one to Holland being operated by a Dutch company with Fokker aeroplanes.

The second group of routes includes the comparatively short run from Bordeaux to Montpelier, with a stop at Toulouse, and the line from Toulouse to Casablanca, in French Morocco. The latter is now running five times a week and has been operating for two years without serious accident, although some parts of the territory flown over present great difficulties in case of a forced landing. The whole distance from Toulouse to Casablanca is covered in two short days' flying, an overnight stop being made at Alicante. The time from France to Morocco by air, even including the intervening night, is less than half that required by rail and boat. There are a couple of additional lines which are in intermittent operation in this territory, and those who wish to visit Corsica may be able to make arrangements for crossing from Antibes and Ajaccio by air if they date their trip properly.

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* In the Christian Science Monitor.

The German lines and those running through northern Europe with Paris as a center, can be considered together, although the only actual point of connection between them is Amsterdam. The most important single route is that from Paris to Warsaw via Strassburg and Prague. The journey from France to Poland is being made in one day at present, having been changed from a two-day journey six weeks ago. The total elapsed time from Paris to Warsaw is 11 hours as against 40 by train, and the fare for the whole trip is only 800 francs, comparing favorably with the railroad rate by train de luxe with sleeper.

It will be noted that there is shown on the map as projected an extension of this line from Prague to Constantinople via Vienna, Budapest, Belgrade and Bucharest. It is the present expectation that this line will be operating regularly by the middle of July and it will therefore be available for the summer tourist traffic. The journey will probably be made in two days with an overnight stop at Budapest. The time by the Orient Express from Paris to Constantinople is about 110 hours, so that the saving in total elapsed time will again be more than one-half. When this line goes into effect, the principal cities of every large state in Europe except Bulgaria, Italy, Greece, Russia, and the countries on the Scandinavian and Iberian peninsulas will be connected by air.

Looking the other way from Paris, the line from Paris to Havre is seen to be marked as in intermittent operation, but aircraft meet all the large liners and the voyager can therefore transfer immediately from marine to aerial transport. If it is desired to visit Germany and northern Europe from Paris, the distance from Paris to Amsterdam can first be covered by air in four hours with stops at Brussels and Rotterdam. At Amsterdam one changes for a German-controlled line to Bremen, whence it is possible to fly directly to Hamburg, to Berlin or to Leipzig or various of the islands along the Frisian coast. The definite time-tables are not yet at hand this year for the German lines but it is probable that arrangements can be made by taking passage from London early in the morning to travel from London to Berlin in a single day.

Arriving at Berlin, further passage by regularly operated lines can be secured to any of the principal cities of the Baltic states as far north as Reval. There has been much discussion of a line to Moscow, but it does not appear to be in regular operation at present. The traveler wishing to visit Soviet Russia late in the coming summer, however, may safely plan on the basis of being able to make the trip from Paris or London entirely by air.

A number of the short lines in Germany have been omitted in this discussion. They are shown on the map, however, and almost all of those there indicated went into daily operation on the 15th of April.

As an indication of what can be done by air, a sample trip may be instanced. A voyager arriving at Havre can go from there to Paris, to Strassburg, to Stuttgart (this last short link by rail) and thence successively to Nuremburg, Leipzig, Berlin, Hamburg, Bremen, Amsterdam and London. The total distance traveled by air is about 1500 miles, while that by rail is less than 50. The journey could easily be made in five days or in four, if one were fortunate in making connections, and the total cost would be about $135.

Standardization and Aerodynamics

By Dr. A. F. Zahm

In Charge of Aerodynamical Laboratory, Bureau of Construction and Repair, U. S. N.

WITH further reference to the article on "Standardization and Aerodynamics," published by William Knight in the Aerial Age of June 20, 1921, and the subsequent discussion in the Aerial Age of the suggestions therein contained, as contributed by Prof. Prandtl (October 3rd, 1921), Prof. von Karman (January 2nd, 1922), Col. Costanzi (February 20, 1922), W. Morgoulis (March 6th, 1922), Col. Verdnzio (April 3rd, 1922), Dr. Katzmayr (May 8th, 1922), Dr. Wolff (June 19th, 1922), regarding the comparison of methods of aerodynamic measurement and expression, I should say that it would now be opportune to have a representative committee appointed to formulate a program for such work.

The inclusion of a very great number of laboratories in the comparative tests does not seem advisable at the beginning. If a few of the foremost ones, testing not too difficult models, can obtain identical results, a good start will have been made. Such tests already are in progress in this country and elsewhere, but without a common plan of attack, and without a common formulated theory to furnish guidance and precaution.

The experimental program should be at least as comprehensive as the one proposed by Dr. E. B. Wolff, in the Aerial Age Weekly for June 19, 1922. An accurate exploration of the air stream, before the insertion of the model and during the test, should especially not be overlooked by the experimentalists. In two papers published by the National Advisory Committee for Aeronautics*, I emphasized this feature when the Committee was working on its program for comparative wind tunnel tests.

The most direct way to study accurately and convincingly the correction to be made for Reynolds number vl/D, in applying model data to aircraft, would be to insert the full-scale craft in a wind tunnel of suitable size. A fully equipped aeroplane, for example, could easily be supported on a wire balance in such a tunnel, and given a comprehensive test when in natural working condition, including its power plant and observers.

Such a tunnel should have a throat measuring in cross-section rather more than 10 x 20 meters, and maintain a uniform air stream at 10 to 30 or more meters per second. The propulsive system required to maintain such a stream, at 100% efficiency, would be of slightly less than

(*Concluded on page* 474)

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* Report No. 139, Influence of Model Surface and Air Flow texture on Resistance of Aerodynamic Bodies.

Note No. 23, Horizontal Buoyancy in Wind Tunnels.

Helium

By R. B. MOORE

Chief Chemist, Bureau of Mines

THE story of helium is one of the romances of science. Probably nothing, except perhaps radium, compares with it in human interest. Helium is one of the best examples of a discovery in pure science that has wide commercial application. In 1868, an eclipse of the sun was visible in India, several scientific men who were in India making observations of the eclipse turned a spectroscope for the first time on the solar chromosphere—that part of the atmosphere of the sun, about 10,000 miles deep, which merges into the corona. A bright yellow line was observed and was thought at first to be due to sodium. Janssen showed, however, that this line was not just the same as either D_1 or D_2 line of sodium, athough it was extremely close to these lines, hence he suggested that the new line have the designation D_3. Frankland and Lockyer decided that D_3 was due to an element in the sun not previously discovered on the earth, and suggested for it the name "Helium" from the Greek word "Helios" the sun.

For several years nothing more was done in connection with this element. In 1894, Sir William Ramsay, in conjunction with Lord Rayleigh, made his memorable discovery of argon in the atmosphere, which was announced at the British Association meeting in the same year. After this discovery, Ramsay looked for other sources of the element. Through Sir Henry Miers, he learned that Dr. W. F. Hillebrand, of the United States Geological Survey, had obtained an inert gas from certain uranium minerals, which gas he had decided was nitrogen. Ramsay believed that part of it might be argon; he obtained from Hillebrand for experimentation, a sample of the mineral, cleveite, one of the uranium minerals, and after extracting gas from the mineral and purifying it, he ran it into a spectrum tube. The lines obtained were, however, different from those of argon; among them was the bright yellow line noted by Janssen. Thus was terrestrial helium discovered.

Helium was found in the atmosphere, in the proportion of one part by volume in 185,000. From samples of air taken at an altitude of several miles and analyzed, the proportion of helium has proved to be about the same as at lower levels; at extremely high altitudes, such as 100 miles or more, the proportion may, however, be much increased. Helium is also found in very minute quantities in sea and river water; undoubtedly it exists in some of the fixed stars, as well as in the sun, and its presence has been spectroscopically determined in many nebulae. Helium is found in the gases evolved from many mineral springs; some contain a high percentage of helium, notably the gas from mineral springs at Mazieres, France, which has over 5 per cent of helium, and two springs at Santenay, France, with more than 8 per cent. But the total amount of these gases is relatively too small for extraction of helium from them to be feasible for practical uses. Helium is found also in some volcanic and fumarole gases, such as the steam issuing from the boracic acid fumaroles of Ladarello, Italy, which contains a small percentage; and in many rocks and minerals, being almost always associated with those of radioactive character. All thorium and uranium minerals contain helium in appreciable quantities; the gas can be obtained by heating the mineral strongly in a vacuum, or by dissolving it in acid. Some radioactive minerals yield from one to five cubic centimeters of helium per gram.

In 1907, Cady and McFarland, of the University of Kansas published a report on the presence of helium in several natural gases, mainly Kansas gases. Some of the samples tested ran as high as 1½ per cent of helium by volume. This work of Cady and McFarland disclosed the information necessary for the inauguration of the helium "project" during the war.

To date no one has succeeded in combining helium with any other element, or in inducing the gas to take part in any chemical reaction under any conditions. In this respect, it is similar to other rare gases of the atmosphere—neon, argon, krypton, and xenon. Helium is only slightly soluble in water. Its thermal conductivity is fairly high, but it is less than that of hydrogen. A volume of helium weighs about twice as much as an equal volume of hydrogen, under identical conditions of temperature and pressure. It is a good conductor of electricity, being next to neon in this respect. Under similar conditions it conducts a current 25 times as readily as air. After overcoming immense difficulties, Professor Kammerlingh Onnes, of the University of Leyden, in 1908, succeeded in liquiefying helium. The liquid boils at -268.75° centigrade or 4¼° absolute. Solid helium has not yet been obtained.

Before the World War, the Germans had developed a type of dirigible called Zeppelin, after Count Zeppelin, its inventor. In the early stages of the war, the Germans used dirigibles largely for bombing, particularly over London and the munitions district of England. Though minimized as long as the war was in progress, the damage done was great. Another use for dirigibles, recognized by military and naval men as probably more important than bombing is scouting. The German fleet never ventured from port without two or three scouting dirigibles which at all times informed the fleet below of the near approach of British war vessels. The German fleet could then accept battle, or retire to its base.

The French and British had no dirigibles at the beginning of the war, but later hastened to repair their deficiency. From experience gained in the defense of London and other important points, it was recognized that the dirigible was vulnerable—extremely so, against a well-organized attack. The Germans too recognized this and invariably made attacks on England at night, operating from a high altitude in order to minimize attacks by aeroplane, as a single incendiary bullet fired into a dirigible would quickly bring the huge ship down, a mass of flames. The inflammability of the hydrogen contained in the ship was the one weak point in this method of attack. The constant danger of a swift and terrible death had its effect moreover on the nerves of operating crews, lessening their efficiency. The remedy for this situation was, of course, to be found in a non-inflammable gas, light enough to replace hydrogen as a lifting force; helium is the only gas known to have these qualities. The use of helium has still other advantages: It diffuses through a fabric at about three-quarters the rate of hydrogen; its non-inflammability makes it possible to place the engines in the framework of the dirigible, thus getting a direct drive, giving greater control of the craft, and much increased speed for any given horsepower.

Early in 1915, word came to an official of the Bureau of Mines that the British were interested in sources of helium for use in dirigibles. When the United States entered the war in 1917, helium for use in dirigibles was discussed among Bureau of Mines' officials, and in June the matter was presented to the Army and Navy Air Services as a war project. These services enthusiastically approved the proposition, and allotments of money were made from the Army and Navy appropriations to carry it forward.

Three experimental plants were constructed in Texas, under the direction of the Bureau of Mines, two at Fort Worth, for economic reasons; one plant used the Linde system of liquefaction, the other the Claude system, and the supply of gas was piped to the plants from Petrolia, Texas. Analysis had showed that this gas contained .95% helium. Another plant was later constructed at Petrolia, near the gas wells, and use was made of a new method of liquefaction, called the Jefferies-Norton process. All three plants produced helium, but the Linde plant proved the most efficient, and it was decided to construct, under the cognizance of the Navy, a much enlarged plant for obtaining helium in greater quantities. The construction of this plant was started in October, 1918; it was completed in December, 1920, and was operated during part of 1921. It produced altogether about 2,000,000 cubic feet of helium, which, with the helium obtained at the smaller plants during the experimental period, makes available at the present time a total of about 2,400,000 cubic feet of helium over 90% in purity. Most of the gas is around 95% grade.

Before the completion of the large plant, the two experimental plants at Fort Worth were shut down and dismantled. The plant at Petrolia, Texas, was continued, however, until July, 1921, on a purely experimental basis. It was then shut down, and at the present time is being kept in a standby condition.

The method of operation in all of these plants is, in general, the same, although there is considerable difference in detail. The object is to liquefy all of the elements making up the natural gas except the helium, which does not liquefy at the temperature used. After liquefaction of all other constituents in the gas—such as nitrogen, methane, ethane, propane, and butane—the helium can be pumped off. Thus far, helium has been obtained in two stages. One stage in operation gives about 70% purity; this has been refined up to 95%. In the second operation the nitrogen, representing practically all the impurity, is liquefied and the helium is once more pumped off.

No production of helium is now in progress, but funds will probably be furnished by Congress to run the large plant at Forth Worth practically during the whole of next year. Under such conditions, from eight to ten million cubic feet of helium may be obtained.

Two helium repurification plants have been constructed by the Army, and the Bureau of Mines is cooperating in installing the final liquefaction equipment. One of these is at Langley Field, Va. In this is used an expansion engine refrigeration system, with heat interchanges, and an especially designed purifier. This plant will be used for refining helium after it has been used in a balloon or dirigible and has become contaminated with air by interchange through the fabric. When the grade of the gas is reduced to 85%, its lifting power (which is normally 92% that of hydrogen when both gases are 100% pure) is too low for practical use, and the gas must be refined. After being refined, it can be used again.

The other repurification unit has been installed on two railroads cars. One car contains the power plant, and the other the compressors and liquefaction equipment. These can be moved from place to place as needed. The use of charcoal at low temperatures for repurification will be tried in this plant. Charcoal exercises selective action in absorbing air and nitrogen, taking them up freely, whereas helium is scarcely absorbed at all. In this way a separation of helium can be obtained.

Complete equipment for conducting research at low temperatures, the Cryogenic Laboratory of the Bureau of Mines, is located at Washington in the Interior Department building, representing the research department of the whole helium project, and employing a force of 12 men. Fundamental information is being obtained that is essential for the construction of any new plant designed to have greater efficiency than the large plant at Forth Worth. Helium can probably be produced in this plant for 10c a cubic foot, but it is believed that the cost can, ultimately, be reduced to 3c and perhaps to 2c. Necessary information is being gradually accumulated to this end.

The Government's entire helium program is now carried on under the general authority of the Army and Navy Helium Board, consisting of a representative, each, of the Army and Navy, together with a delegate from the Bureau of Mines.—Reports of Investigations, U. S. Bureau of Mines.

New Navy Seaplane Engine

A MARKED feature of aeronautical engine development in this country is the encouragement by the Bureau of Aeronautics, Navy Department, of independent development of aircraft engines for the prospective requirements of naval flying.

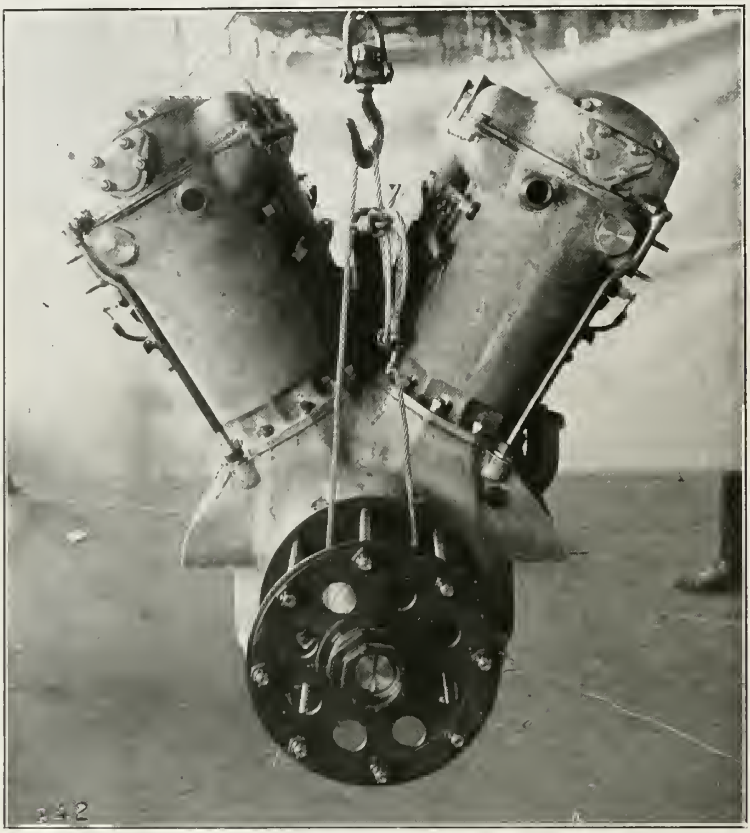
An interesting result of this encouragement, is the development by the Wright Aeronautical Corporation, of a new 12-cylinder engine, known as Model "T-2." This engine was designed to meet the Navy Department requirements. and has been built on Navy Department orders. It is designed for heavy duty service sea planes, whose long flights require great durability, and on account of the weight of gasoline necessary, the engine had to be economical as possible. Notwithstanding these primary considerations, this engine, as developed, seems to have a wide range of application, owing to its low weight per horsepower.

Some of the "T-2's" mechanical features are believed to be entirely new. These include a form of crankcase, in which the crankshaft is held in the upper case by bearing caps, rather than by the upper and lower halves together; a form of can box, which not only carries the camshafts and rocker arms, but also forms a truss at the top of the cylinders. Integral with each cam box is an intake manifold, so designed that the carburetors may be placed either below the crankcase or in the V. An open end cylinder sleeve construction and the use of aluminum bronze valve seats are also new features. Refering to the photographs, we note that the cylinders are cast of aluminum in four blocks of three, and that a single cam box covers the six cylinders of each bank. In order to give the reader an idea of the size of this engine, it should be noted that it is slightly shorter than the Liberty, and fits into the same bed timbers. The details of the engine itself are as follows:

Bore, 5¾ ins.
Stroke, 6½ ins.
Piston Displacement 1947 cu. ins.
Rated H. P., 525 at 1800 R.P.M.

The engine is purposely somewhat throttled, in order to increase its ability to run for long periods, without decrease of power, and with a very low fuel consumption.

One of the interesting details of the engine is the cylinder construction. This permits of an aluminum combustion chamber in direct contact with the cooling water. A removable wearing surface is provided for the



Wright Seaplane Engine Model T-2

piston by the use of an open and steel sleeve, which is shrunk into the aluminum cylinder casting. The valves and spark plug bushings are seated in aluminum bronze rings shrunk into the cylinder heads. This construction provides for adequate cooling for both these important parts, and is considerably different from that used in the standard Wright engines heretofore, in which closed and steel cylinder sleeves were used. Four valves are used per cylinder. The valves are inclined at a small angle, and are actuated by rocker arms directly from a single camshaft housed in each cam box mentioned above. These rocker arms are carried on light steel tubes running parallel with the camshafts, which can be withdrawn from the end of the cam box, thus permitting the removal of the rocker arms. The lubrication of all of the valve-operating mechanism is effected by oil carried under pressure in the rocker arm tubes. Overflow pipes are provided to return the oil to the crankcase.

Valve adjustment is taken care of by adjustment screws on the rocker arms, and in order to facilitate this adjustment the cam box has a light two-part top, which can be easily removed, enabling a mechanic to adjust all valves and inspect the rocker arms, camshafts, bearings, etc. The design of the pistons present no radical features. Three compression rings above the pin and a scraper ring on the skirt are used. The floating type of piston pin, with bronze retaining plugs, is provided. The inner and outer connecting rods have a tubular cross section, the outer rod being forked to hold a new type of connecting rod bearing. This bearing is a split sleeve and is made of a new material, which does not require a babbitt facing. The inner connecting rod bears directly on the outside of this bearing, and the bearing itself bears on the crankpin. The crankshaft is exceptionally robust, having 3-inch diameter main and crankpin bearings. Seven main bearings are used, the center and front bearings being very long. The propeller thrust is taken by a deep row radial bearing. The propeller end of the shaft is interesting, as it embodies a new design of hub fastening. The shaft itself is splined with 17 splines. The drive is through the splines from the crankshaft to the propeller hub. The hub is centralized by a pair of tapered cones, one at each end of the splines.

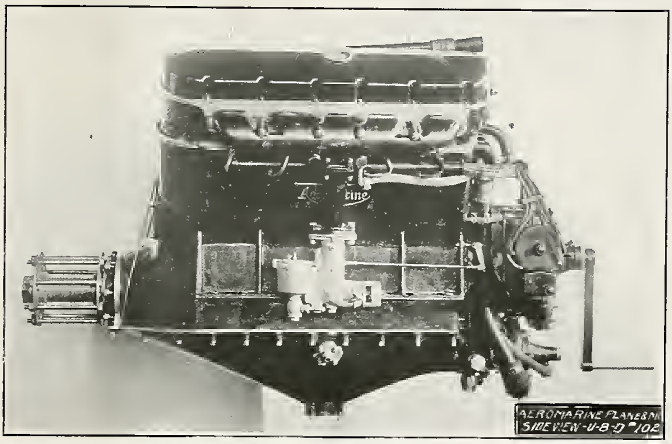
Details of the crankcase are most interesting, as the design, which was first used in the Wright dirigible engine, provides an exceedingly neat and stiff girder for carrying the engine stresses. The method of construction might almost be called a one-piece crankcase, as the lower portion is only a bottom pan containing the sump and carrying the oil and water pumps. The main bearings are, as before stated, held in place by bearing caps. This method of construction makes it perfectly possible to remove the under pan, which contains no mechanism for which any re-adjustment is required, and thus inspect the main and the connecting rod bearings without removing the engine from the aeroplane.

The drives for the magnetos, camshafts, oil and water pumps, as well as the synchronizers, have been laid out with a special reference to accessibility and ease of adjustment. Not only are these drives arranged in a flat, compact form, as will be seen from the illustrations, but provision is made for a generator or fuel pump drive in the Vee, and a hand or electric starter, or other auxiliary, at the rear of the engine. Water is carried to the lower side of each bank of cylinders through suitable piping from the pump, and is taken out at the propeller end of each cylinder bank. The oil passes from the pressure pump through a large cylindrical strainer, and is fed to all parts of the engine under a pressure of 75 lbs. per sq. in., the only parts lubricated by splash being the pistons and wrist pins.

The ignition is by two SS-12 Splitdorf magnetos, one magneto firing all the inside plugs, and one the outside. Two separate carburetors, as seen in the illustration, are of the latest Stromberg aviation type. This engine, in accordance with the Navy Department's requirements, was built to run on standard domestic aviation gasoline. Furthermore, all parts, including spark plugs, crankcase bolts and oil strainer, are so placed as to be readily accessible and easily disassembled in the aeroplane.

The Model "T-2" engine, above described, has recently been accepted by the Navy Department, after an official 50-hour test, in which the engine developed an average of 500 h.p. at 1800 r.p.m. During this test the average fuel consumption was .48 lbs., and the average oil consumptoin .02 lbs. per b.h.p. hr.

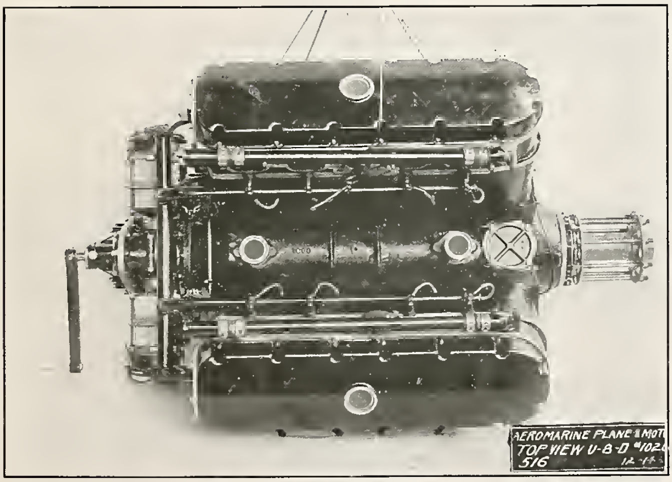
Aeromarine Aircraft Engine Sets World's Record In Endurance Test



Side view Aeromarine U-8-D engine

THE Navy Department, Bureau of Aeronautics, have inaugurated new test conditions for aircraft engines which mark a new step in aviation development. In the past it has been the rule to prove new types of engines by a fifty-hour endurance test, run in five-hour periods. This test has generally been regarded as one of extreme severity and the few types that have successfully completed this period without major failures have been considered to have entirely proved their suitability for aircraft use. Realizing that the next step in aeronautics is the development of engines of greater durability, the Bureau has increased the length of their tests to six times the old standard, or three hundred hours. This ultimate limit was set in the expectation that any existing engine would have been run to destruction before that length of time, so that the actual life could be determined. The test, however, failed in its intention in the case of the Aeromarine U-8-D, which is still pulling its full horsepower and functioning perfectly in all respects at the end of the three hundred hours. Several engines have attempted this test, but as yet only the Aeromarine U-8-D has successfully completed the entire three hundred hours.

The test is run in three main periods of one hundred hours, each including eighty-six hours at flying load, followed by fourteen hours at full throttle. After each hundred hours the engine was put through a complete series of tests to check up horsepower, fuel consumption, etc., and was subjected to detail examinations for wear. These tests were observed and all records checked and certified by Navy Inspectors working in three eight-hour shifts—to get in three hundred hours, working the standard forty-four hour week, would have taken almost seven weeks.



Top view Aeromarine U-8-D engine

The following facts are of interest and help towards a realization of the arduous conditions to which a test of this kind subjects the engine:

Each of the pistons as it reverses its direction of travel at the end of each stroke is brought to a stop, while at the middle of the stroke it is travelling at a rate of 38 miles an hour at 1700 revolutions per minute, rated engine speed. That is to say, in 1/112 of a second the piston speed is brought from zero to 38 miles an hour and is brought to zero again in the next 1/112 of a second. Each of the eight pistons continued these 112 accelerations per second for three hundred hours or 120,000,000 times. The explosion load on each piston is in excess of four tons and one hundred explosions occur per second.

The average horsepower developed was 175, which is sufficient to propel a five-passenger aeroplane at a speed of about eighty miles an hour and in the time of the test such a plane would have flown completely around the world.

The total amount of work done by the engine is equivalent to lifting a weight of one ton to a height of 1,270 miles.

Sixteen tons or 5,300 gallons of gasoline were used in this test.

The equivalent gasoline consumption in the plane would have been four and three-quarter miles per gallon. The average oil consumption was .0086.

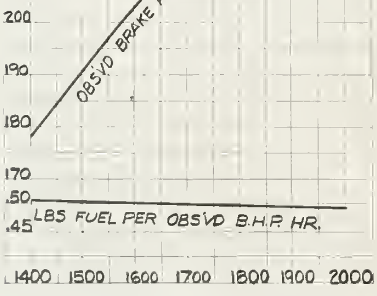
The tip of the propeller used on this test travelled 91,200 miles or almost one-third of the distance from the earth to the moon.

During the test the engine made over 31,000,000 revolutions and almost 9,000,000 revolutions between stops. As a comparison it may be stated that the ocean liners average about one-half million revolutions of the engines on the trip from Liverpool to New York.

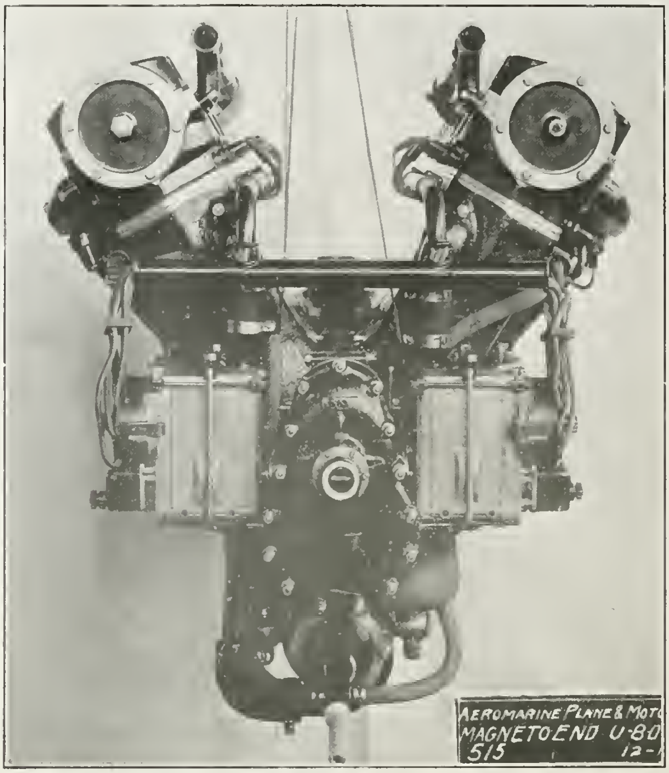
During the test the pump on the engine circulated 2,726 tons of water.

The long valve life demonstrated in the test was deliberately aimed at, and very special attention was given to the valve seat and guide. The seat is cast into the head, which gives better thermal contact than any other known method of uniting two pieces.

The connecting rod bearings on the U-8-D have the same area as the 400 H.P. Liberty Engine, while the crankshaft bearings are considerably larger. Very special precautions are taken to insure extreme rigidity in the bearing shells and there is incorporated in the oil system mechanical means for trapping all the dirt in the oil before this reaches the bearings. This has resulted in exceptional bearing life.



Power curve of Aeromarine U-8-D engine after completing 300-hour test



Anti-propeller end view Aeromarine U-8-D engine

The cylinder sleeves, which are removable for replacement, are in direct contact with the cooling water. These provisions together with the carefully developed water circulating system which concentrates the flow at the points where most needed, make the U-8-D Engine particularly insensible to water temperature conditions.

In order to keep vibration to a minimum the angle between the cylinders on the Aeromarine is made 60°. The 60° design gives a constant rotating out-of-balance force of exactly one-half the magnitude of the unbalance in a corresponding 90° engine.

The detachable head construction of the Aeromarine affords ideal accessibility for the complete valve mechanism. Heads can be changed in a few minutes, by which means a complete tope overhaul of the entire valve mechanism is effected, while necessary adjustments are made on the bench. The Aeromarine design affords quickly detachable and interchangeable cylinder sleeves.

For future production, modifications are being made to this engine whereby the weight is being very materially reduced on those parts which do not affect the life of the engine. At the same time the bore is being increased so that Type U-873 will be rated at 250 H.P. and in the high compression type will develop upwards of 275 H.P. The weight is 520 lbs., giving a weight factor of 1.9 lbs. per H.P. in this U-873 Type. This weight reduction is being achieved in spite of the fact that all parts which showed less than 100% perfect at the end of the 300 hours in the test are being strengthened or otherwise modified to bring them beyond the 300-hour standard.

The M. I. T. Soaring Machine

By Frank M. Gentry

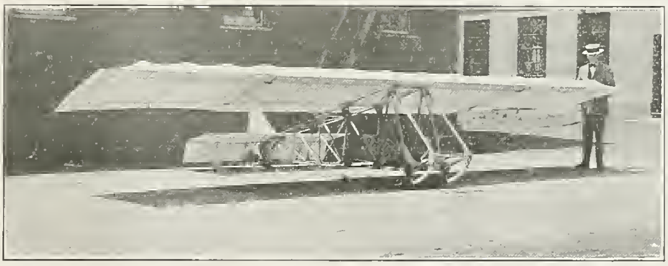
Member Managing Board Aero. Eng. Soc. of Mass. Inst. of Tech.

BEFORE the advent of the aeroplane, the attention of the public had been directed in part to the experiments of Chanute, Lilienthal, and Montgomery, whose performances in heavier-than-air contrivances furnished a substantial background for the present development in the art of flying. With what now appear to have been crude assemblages of wood and fabric, they actually succeeded in making short flights, or more properly, perhaps, *air-slides*, which in those pre-modern days of aviation was a noteworthy accomplishment.

Of no less importance were the early experiments of the Wrights at Kitty Hawk, N. C., which resulted in the installation of the first power unit. Once the machine was constructed, gliding was simplicity itself. It merely involved utilizing gravitation and the opposing air pressure to produce translatory motion. In other words, gliding amounted to nothing more than sliding down an inclined plane of air along the path of least resistance under the influence of gravity. Birds had been observed to glide, but more than that, they had been observed to *soar,*—rise, gain altitude, without the slightest effort on their part to furnish the propelling force. Their native instinct enabled them to sense and use to great advantage the stored energy of air currents and wind puffs. But Nature was not longer to keep her secret from man when Orville Wright in 1911 demonstrated by remaining aloft nine minutes and fifty-four seconds that a heavier-than-air machine could be sustained by the motion of the winds.

This was the first step in soaring flight, but there the matter stood, almost forgotten, for nine years. The great strides in aircraft development and later the Great War thrust it into obscurity until revived by the enthusiasts in Germany after the wings of the Central Powers had been clipped by the Versailles Treaty. Thus arose the new art of utilizing the wind currents in sustained flight.

Motorless flight includes both soaring and gliding flight. Gliding is always the outcome of soaring; the machine soars with every available wind to gain altitude and then glides toward its destination. Granting the existence of the proper currents, soaring depends primarily upon the skill of the pilot and secondarily upon the maneuverability of the plane. This last consideration imposes special requirements in design.



The M. I. T. Soaring Glider

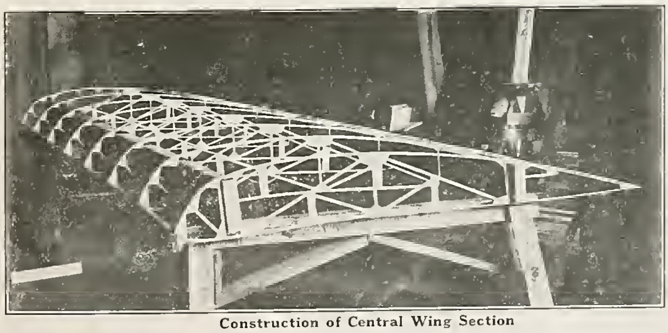
Little need be said of the performances of the Aachen, Harth, Hannover, and von Lossel machines in the Rhoen Valley, as much has already been published, but they may be referred to later for comparative purposes.

The awakening in America naturally followed the rapid spread of enthusiasm throughout Europe. The Aeronautical Engineering Society of the Massachusetts Institute of Technology was one of the first to become interested in the introduction of soaring flight into the United States.

Early in January, after much preliminary discussion on the part of the members most interested, a committee was appointed to make plans and direct the construction of a soaring plane. The two most serious problems confronting the committee were the questions of finance and man-hours. The necessary funds were finally secured by popular subscription among the society membership. A questionnaire was submitted in which each member was asked to fill in the number of man-hours that could be expected from him. With these obstacles successfully surmounted, the committee announced a competition for designs. Out of some five designs received, the judges, Prof. E. P. Warner of the department of Aeronautics acting as chairman, declared Mr. C. T. Allen and Mr. O. C. Koppen winners of the competition.

The original plans were slightly modified to give larger control surfaces and to facilitate ease in construction. The available labor being limited in time and skill, simplicity of construction was one of the deciding factors in the design competition. No variable wing section was attempted. Although the initial plans called for a streamlined fuselage, careful analysis seemed to indicate that the results would not warrant the decreased visibility for the pilot or the attendant structural complications.

The usual stress analysis was made so that the factor of safety would not fall below six. Duplicate pieces were made of the important parts of the machine and tested for their breaking strength in the Testing Materials Laboratory of the Institute. For the most part it was found that the break-



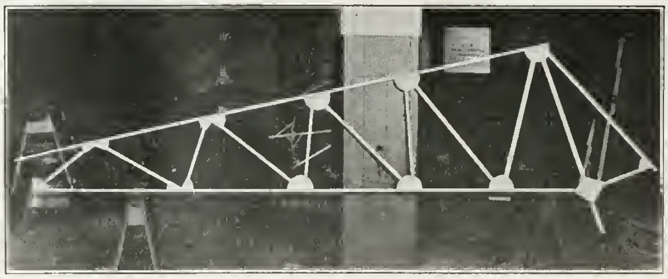
Construction of Central Wing Section

ing strength far exceeded the required values.

The Technology soaring plane is of cantilever construction. It has a hundred and twenty square feet of supporting surface and tips the scales at a fraction less than seventy-three pounds. While every effort was made to lessen the weight without reducing the strength by the efficient use of materials, its lightness exceeded the expectations. Allowing a hundred and thirty pounds as the weight of the pilot, this gives a flying load of one and seven-tenths pounds per square foot. This is about the carrying capacity of the condor and is slightly greater than the loading of the principal successful foreign soaring machines. The wing has a spread of twenty-four feet, a chord of four feet, nine inches and an aspect ratio of five.

A Martin No. 2 wing section was selected as the most suitable for the conditions of soaring flight. The ribs have a maximum depth of seven and one-half inches and weigh four and one-half ounces each. Under actual test, this rib withstood a distributed load of one hundred and ninety-eight pounds before shattering. It is designed to carry a load of sixty pounds, allowing a factor of safety of six. All the ribs are identical except the end ribs which have a depth of two and one-half inches and are cut from ply-wood. The ribs are constructed of spruce with ply-wood gusset plates, glued and tacked at the joints. Their carrying capacity of forty-five pounds per ounce of weight is somewhat remarkable.

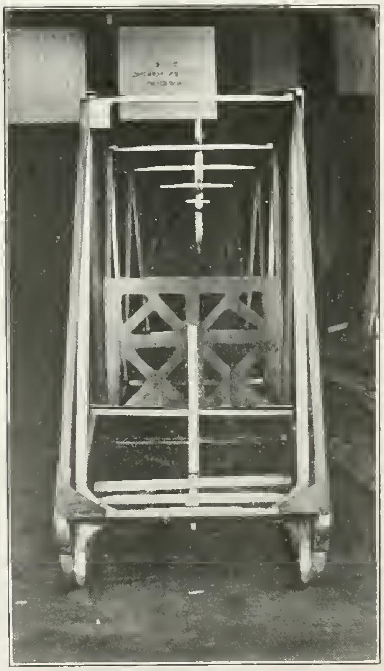
The wing is made in three sections to permit ease in transportation. The central section is twelve feet long while the end sections are six feet. The wing spars are of the conventional box type construction of three-quarter inch spruce cap-strips and sides of three-ply ply-wood. The elements are glued and screwed. Two wing spars are provided and, while they are not identical, their depth was made as great as the wing section would permit in order to obtain maximum rigidity. The spars of the central section are tapered in the horizontal plane while those of the end sections are tapered in the vertical plane. The entire wing can be quickly assembled and made secure by means of eight steel bolts in thin sheet steel fittings. When tested, one of these fittings withstood five thousand, two hundred inch-pounds before the supporting frame broke and the rest of the test was abandoned. The internal bracing consists of diagonal guys and light compression members at the ends of the sections. The former are of piano wire made taut by means of turnbuckles made from bicycle spokes. The ribs are braced by interwoven tape strips. A balloon cloth weighing one and nine-tenths ounces per square yard forms the covering. Two coats of a special glider dope were applied. The wing has no dihedral, thus permitting greater ease and strength in construction.



One of the fuselage trusses

The fuselage is of the customary rectangular section, tapering to the rudder post at the rear. For the most part, it is constructed of spruce, although the front members are of ash to add greater strength near the landing gear and pilot's seat.

The joints are made with 3/32 inch ply-wood gusset plates glued and screwed. Under test, a sample joint broke at five hundred and sixty pounds. Each fuselage truss is ten feet long, twenty inches high and weighs four and one-half pounds. The wing is fastened to the fuselage by means of four steel fittings which were found to have a breaking strength of eleven thousand pounds. Little labor is involved in detaching the wing for transportation. A noticeable feature is the absence of external wires, none being present except those necessary for the manipulation of the controls.



Front view of fuselage

The machine is equipped with the usual number of control surfaces. Comparatively large surfaces were used to obtain greater maneuverability. The stabalizer has a span of seven and one-half feet and a width of one foot, nine inches, giving an area of thirteen square feet. Each elevator is hinged to the stabilizer with three light hinges. The elevators are three feet, nine inches long by one foot, seven inches wide. The rudder is approximately twenty-nine by nineteen inches. A slightly smaller rudder was submitted to a sand loading test. The glue under the horn was not dry when the test was made and consequently came loose under a load of eleven and one-half pounds per square foot. The other parts of the rudder showed no signs of breaking. The horns are cut from ply-wood, the holes for the control wires being reinforced with metals washers to prevent wear. The ailerons are six feet long, extending the entire length of the end sections. They have a width of one foot, four inches. A bell-crank control system is used for the ailerons to eliminate the danger of pulleys. A stick and rudder bar are used to manipulate the controls.

The pilot's seat is cut from plywood and is located over the rear portion of the landing gear. Two skids, formed from strips of ash and fastened to the lower longerons, form the front landing device. No shock-absorbing mechanism is provided other than the spring of the skid itself. The tail skid is also built up from ash strips but it is provided with a rubber shock-absorber.

Organizing a Successful Meet

By W. W. Wyman, Mgr., Aeronautical Dept., C. L. Maguire Petroleum Co.

IT is my privilege to attend flying meets in many parts of the country, and I feel it will be a service to aeronautics to tell of the preparation and organization of the most successful meet—the one put on by the *whole* city of Monmouth, Illinois, June 15th to 17th. The population of Monmouth is only 10,000.

About a year ago the Exchange Club of Monmouth, a newly organized luncheon club, composed almost entirely of young business men, decided that they must do something to arouse the progressive spirit of their city. A committee was appointed and after due consideration reported on three plans to accomplish the desired results. They were: (1) An Aviation Field with an annual meet; (2) A City Layout Plan; (3) City Playgrounds.

A fine field was secured one mile from the center of the city, which was leased to the Curtiss-Iowa Aircraft Corporation of Des Moines, Iowa, under contract to equip, operate and maintain a first-class flying field.

The Monmouth Aero Club was then organized with a very large charter membership, who immediately started to work as a *unit* to put on a successful meet. They first secured the advice and counsel of such able men as Major R. W. Schroeder, in charge of the Aeronautical Department of the Underwriters' Laboratories, Inc., and Morrow Krum, aviation editor of the *Chicago Tribune*.

The Curtiss-Iowa Aircraft Corporation took immediate possession of the new flying field, erected a hangar and started operations. The field rapidly gained publicity through several trips to Chicago, strongly featured by Morrow Krum in the *Chicago Tribune*, and many cross-country passenger-carrying trips.

The dates of the meet were set many months in advance and decision made regarding contests and events. The leading merchants, manufacturers and associations were induced to donate a total of nine beautiful silver cups as prizes for the leading events.

75,000 little red stickers, announcing the meet, were purchased and one was pasted on every letter that went out of the city. A supply was given to every traveling man who traveled out of or visited the city, and they plastered them all over Illinois, Iowa and Wisconsin. 2,500 window cards were printed and placed in all stores within a radius of fifty miles. A little folder was prepared, listing the attractions, events and expected visitors, and mailed to Chambers of Commerce, Aero Clubs and operators of aeroplanes. 50,000 schedules of the Chicago-Monmouth Air Route, in operation by the Curtiss-Iowa Aircraft Corporation, were distributed by mail and planes, and then a few days before the meet 25,000 dodgers were distributed by plane over the surrounding cities and towns. In addition to this they advertised in several newspapers in nearby cities, and the Monmouth newspapers, with about 6,500 circulation, ran page after page of free press notices and advertisements.

To quote from a letter from Mr. C. W. Buchanan, president of the Monmouth Aero Club: "We put one man of exceptional executive ability in complete charge as General Chairman to direct all the affairs of the meet, and he in turn appointed his chairmen and assigned to them the various tasks to make up the meet as a whole, and made each responsible for his particular task. This was one of the main contributors to our success.

"We secured the active support of each city and county official and now realize that this support was an essential to success.

"As we had arranged no second prizes we decided to extend the hospitality of the city in entertaining our visitors and guests. On arrival each visitor and guest, including mechanicians, was given a card which entitled him to gasoline, oil, meals, hotel bills, use of Y. M. C. A. swimming pools and full privileges at the Country Club, absolutely free of charge.

"One item which contributed largely to our success was the fine manner in which our traffic was handled, with the result that there were no accidents to cars or pedestrians. This was handled entirely by our local army units, who policed all roads to perfection.

"The road passing the field was confined to one-way traffic and no parking was allowed on any road near the field, though ample parking space was available within the field. This would have been impossible without the co-operation of the county officials.

"Neither were there any accidents to flyers or their ships, due to the able management of Major Schroeder, who had charge of all flying.

"We sold over 3000 advance admission tickets and secured enough rain insurance for the first day to cover our expenses.

"It was a pleasure to see the government pilots ask for service for their ships, then as an afterthought ask what oil and gas we were using, and when they were told it was Lakeside Aviation Oil and Standard's Air Service specification gasoline, to see how well pleased they were and how soon their worry over these items disappeared. Many remarked that we were surely giving away the best obtainable."

There were over 10,000 paid admissions to this three-day meet, which is certainly remarkable for a city of only 10,000 population. These admissions paid all expenses and left a substantial profit. It just shows the real fundamental cause of the financial as well as the operating success of this meet. The whole city, to a man, pulled together as one team with one big idea—a successful flying meet. There were no petty jealousies, no holding back, no pessimists. Everyone, no matter what his position, did what he could to help. Anyone could have asked the Mayor to run a necessary errand and he would have done it without letting it be known that he was the Mayor. Every visitor, whether high army official or mechanician, was treated as if he were the guest of honor. The ones who could take no active part in the planning or organization did take a very active part in making it a success by coming to the meet and paying their admissions. One day of the meet was declared a holiday in the whole city. It was this spirit of unselfish willingness to serve, this spirit of unselfish hospitality, this spirit of united effort that made this meet such a success. And these same qualities displayed by any city or town, no matter what its size, will make it possible for them to run a successful meet. Visitors to the Monmouth Meet will long remember it as the brightest spot in their whole season's work.

Monmouth, Illinois, is destined to be well known in aviation circles, mainly because of its unity of interest in aviation and because of its geographic advantages. It has excellent railroad facilities. It is located about half way, or one-hop distance, in a nearly straight line between six large cities, namely, Chicago and Kansas City, Minneapolis and St. Louis, Omaha and Indianapolis, and very little out of line between Chicago and Omaha. This will make Monmouth the logical stopping place for the air traffic that will some day in the near future operate between all these large cities of the Middle West.

The Aeronautical Situation in Germany

By William Knight, M. E.

SINCE the end of the war (and before) aeronautical interests in Europe both political and commercial, have been looking upon Germany and the development of German aeronautical activities with a great deal of nervousness.

Germany during the war and since the war stopped has made such substantial progress in aeronautics, that the preoccupation of the rest of the world in its progress is quite justified.

The hesitancy and the lack of a well-defined understanding on the matter of aeronautical policies of the allied nations towards Germany has been the outstanding feature of all the governmental conferences which from time to time have taken place among the allies on the matter of future aeronautical developments in Germany.

A short survey of what the allies have tried to do from the time the armistice was signed up to the present time in order to keep the German flag out of the air and the actual results obtained in this direction will probably be illuminating to all those who are interested in the international aspect of aeronautics.

After the armistice Germany delivered to the allies 1,700 aircraft and the peace treaty signed at Versailles on June 28th, 1919, imposed a number of limitations upon German aeronautical activities and reserved a number of rights and privileges to the allies in connection with civil aviation developments in Germany.

Art. 201 of Section V of the Peace Treaty grants to Germany the right to resume aeronautical construction six months after the ratification of the Peace Treaty, namely: July 10th, 1921. Art. 202 imposes the destruction or the delivery to the allies of all military aircraft and aeronautical equipment.

Art. 313-320 of section XI of the Peace Treaty reserves to aircraft of allied nations up to January 1st, 1923, the right to fly over German territory and to participate in the air traffic in Germany under the same rights and obligations as German aircraft.

On June 20th, 1920, it was decided at the Boulogne interallied conference that Germany was not complying with Art. 202 and in order to make it comply with it, the German Government was notified that the provision of the Peace Treaty regulating aeronautical construction in Germany was amended to the effect that Germany could not resume aeronautical constructions before three months had elapsed from the date when the interallied aeronautical control commission would report that the provisions contained in Art. 202 of the Peace Treaty had been complied with.

On July 10th, 1920, Germany, ignoring the decisions taken by the allies at Boulogne, resumed aeronautical construction and the allies found themselves compelled to include in the protocol drawn up at Spa on July 12th, 1920, the decisions taken at Boulogne.

On January 20th, 1921, the allies requested Germany to accept a distinction formulated by them between civil and military aircraft and set May 15th, 1921, as the final limit for complying with Art. 202 as mentioned above. After an ultimatum was sent to Germany on May 5th, 1921, the German Government accepted on May 11th, 1921, the request made by the allies on January 29th.

On November 16th, 1921, 250 new aircraft built since the armistice, in opposition to the conditions laid out by the allies in the Peace Treaty and in the subsequent interallied conferences, were either delivered to the allies or were destroyed. On February 1st, 1922, the council of allied ambassadors decreed that on May 5th, 1922, the limitations imposed by the allies upon the construction of aircraft in Germany would be removed.

May 15th, 1922, is the date which will mark in the future the official starting point of German aeronautical activities.

In the meantime, while the allies were exchanging notes among themselves and between themselves and the German Government on German aeronautical activities in the future, German aeronautics was progressing in the scientific research field, in the engineering and the manufacturing field and in the organization of aerial commercial lines.

The allies left to Germany, after the war, about 100 old types military aeroplanes to be used for commercial purposes and with such material, from April 1st to October 31st, 1921, these aircraft flew more than one million miles, transported 6,800 passengers and 31 tons of mail and merchandise and on May 5th, 1922 the total strength of German aviation (including the 100 aeroplanes mentioned above) was 225 aircraft.

Two important groups of aerial operating companies have been formed in Germany lately and each one of these two groups has been put under the wings of one of the two large shipping interests represented by the Norddeutscher Lloyd and the Hambourg Amerika Linie, respectively. The first group is composed by Albatros, Junkers, Sablatniz, Rumpler, Oriental Lloyd, Schütte-Lanz, Benz, etc. The second group is composed by Deutsche Luft Reederei, Danziger Luft Reederei, Deutsh-Russische Luftverkehrs Gesellschaft, Zeppelin Flugzeugban, Maybach, etc.

Limited in Germany by the Allies German aeronautical activities have developed abroad. In Italy the Germans are now manufacturing metallic aircraft and a line, Berlin, Roma, Brindisi, Athenes, will be inaugurated in the near future. In the United States the Shütte-Lanz Co. and the General Air Service Corporation, have laid out the basis of a very important aerial service operated with German dirigibles. In Spain the "Zeppelin and American Company" has been incorporated with a capital of 80,000,000 pesetas. In Colombia commercial aerial navigation is operated with a German Company. In Switzerland the "Ad Astro" Swiss Company is subsidized by the German Government (6,500,000 marks in 1922). In Russia the first aerial operating company starting operating there is a German company.

As far as the scientific progress in aeronautics is concerned, we can say that Germany is more advanced in aerodynamical research work than any other country and no other country can boast of having such big men in this line of scientific work as Prof. Prandtl, Prof. von Korman, Dr. Betz and others who have enormously contributed to the progress of aircraft development in Germany and outside of Germany.

It is rather amusing to remember that at the first meeting which took place after the war of the "Societé Aerienne" in Paris in which the aeronautical progress in France during the war was reviewed, the lecturers reviewed . . . . the progress made by the Göttingen Aeronautical Laboratory under Prof. Brandtl.

As far as metallic construction is concerned I think it is freely admitted by everybody that Germany is leading the world.

The German government is giving direct assistance to the air transport industry by the payment of a subsidy of 10 marks per kilometer flown for distances under 300 kms., and 11 marks for distances above 300 kms. In addition, in 1921, a sum of 10,000,000 marks was devoted to the relief of aircraft manufacturing companies. The amounts set aside as subsidies for air transports in 1920, 1921 and 1922 are reported to be as follows:

1920, 12,000,000 marks.

1921, 11,000,000 marks (and 1,000,000 marks for meteorological services.)

1922, 40,000,000 marks.

I think that from this brief review of cold facts we can draw only one conclusion and the conclusion is that considering that the allies and the United States have not been able to agree on such a drastic policy as would have kept the German flag off the air for ten or fifteen years at least, we have to recognize the fact that German aviation is a factor to be reckoned with no matter if we like it or not and that the best we can do is to deal with it in the same way as a business concern would deal with a dangerous competitor that cannot be put out of business: to make agreements with him, if possible, on the basis of a reciprocal interest or else to compete with him on the matter of prices and quality.

Navy Changes in Liberty Motor Responsible for Improvement in Navy Plane Operations

ALTERATIONS and changes to the standard Liberty engine, by Navy experts connected with the Bureau of Aeronautics of the Navy Department have been responsible for the vast improvement in operating conditions of Navy planes and have made possible long distance flights without mishap or even so much as the change of a spark plug.

The increased reliability of the Liberty engine has been the subject of report and comment by commanders of Naval Air Squadrons operating with the fleets and letters of commendation have been sent to the officers responsible for the improvement by the Chief of the Bureau of Aeronautics.

The Liberty engine which was brought out in this country during the war was designed to fulfill an urgent need for a standardized aircraft engine that could be placed in quantity production at a time when the air forces of the country were expanded from a negligible quantity to a vast fleet of planes outnumbering that of any country in the world. At the time the Liberty engine had the unqualified support of designers and manufacturers in this country, and it was the best product obtainable in aircraft engines. Foreign critics condemned it in no uncertain terms and on numerous and varied counts. In the light of later experience, it has developed that the Liberty was not as was at first claimed for it the perfect aircraft engine. It had many inherent faults which contributed to unreliability and caused many failures and forced landings. On the other hand the many good qualities of the engine were such as to stimulate every effort to correct existing deficiences rather than to turn to new design. To this end the Bureau of Aeronautics tackled the problem and by starting with the greatest difficulties and working down through to minor faults were able by progressive steps to place at the service of the Naval Air Squadrons engines capable of any duty that might by required of it with a maximum of dependability and endurance.

At the time of the Armistice the Navy had some 4,000 Liberty engines representing an outlay of approximately $16,000,000 of government funds. The engines were subject to unanticipated derangements which necessitated forced landings of frequent occurrence and general overhauls. It will be clear to anyone who has had the least experience with automobile engines that the faults found with the Liberty were such as to cause continuous trouble and derangement.

Among the difficulties experienced were trouble with breaking of timing gears, the oil consumption was excessive, and much trouble was experienced with spark plugs due to their fouling up particularly at low speeds. Cylinder jackets caused considerable trouble from cracking, allowing loss of water which usually resulted in forced landings. Generator failures was another source of trouble and at first it appeared that the inherent design of the Liberty engine was at fault.

The most serious fault encountered was with gear failures and it was to this, that the naval technicians gave first consideration. A re-design of the timing gear was effected and the trouble was completely eliminated. Next the pistons were modified by cutting a groove around the edge of the lower piston ring groove and drilling oil return holes to the inside of the piston. With this change the spark plug troubles were eliminated as it prevented oil from getting into the combustion chamber. It also reduced the oil consumption and as a result of this the oil pressure was raised. With increased oil pressure the bearing life was lengthened and this lengthened the time between overhauls.

In order to eliminate generator failures a flexible drive was substituted and up to the present time has proved altogether satisfactory in flight test. To overcome cylinder water jacket cracking a re-enforcing strip has been welded across the top of the cylinder on the inside of the water jacket with excellent results.

The Liberty engine ignition system had never been entirely satisfactory and recent changes by the Bureau of Aeronautics include the substitution of a twelve-volt ignition system in place of the eight-volt system. This substitution was such that it did not permit the battery to discharge so rapidly. It also allowed much easier starting.

With the above changes in effect the Liberty engine has been in use in planes in the operating squadrons throughout the past winter and spring with excellent results. During the recent ferrying of twelve F-5-L seaplanes from Hampton Roads to Pensacola the performance of the motors reflected the generally excellent results that have been uniformly attained. With the exception of one forced landing due to a leaky water jacket, the engines came through twenty-five hours of flying without the slightest trouble.

In a report to the Bureau of Aeronautics the Commander of the Air Squadrons, Atlantic Fleet, pays high tribute to the work that has been done in this connection:

"In general all the modifications to the standard Liberty have proved of great value," says the report. "The increase in oil pressure has probably doubled the life of the motor." The use of heavy gears has eliminated trouble from this source provided the commanding officers will give their power plants the ordinary care accorded steam power plant machinery.

(*Continued on page* 478)

AERIAL AGE

PUBLISHED MONTHLY

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5942 Grand Central Terminal, New York

Vol. XV SEPTEMBER, 1922 No. 18

The Detroit Races

AS we go to press over fifty aeroplanes are entered in the National Aeroplane Races to be staged at Detroit from October 7 to 14. There are twenty-three confirmed entries for the Pulitzer Race alone, and it is expected that there will be several others before the list is closed. This contest, with the wide range of types of machines entered, cannot fail to be a classic, and it is to be hoped that the efforts of the Aeronautical Chamber of Commerce will be successful in securing worthy foreign entrants.

The program arranged by the Detroit Aviation Society should have the practical endorsement of everyone interested in aeronautics by their attendance at Selfridge Field from October 7 to 14.

Who Owns the Air?

IN order to assure the future of aerial navigation it may be necessary to carry to the Supreme Court of the United States a case just decided by a justice of the peace in Punxsutawney, Pa.

Over a farm in that euphonious locality flew an aviator utterly disregarding the "No Trespass" signs that were posted upon it for all men to see and take warning.

The flyer, not content with being a mere bird of passage, paused in mid-air to do various hair-raising "stunts," causing the landholder to apprehend that the bird-man might at any minute plunge downward into a grain field or damage a cow beyond repair.

He therefore hastened to the justice's office and secured a summons for the offender, who later was fined the sum of $1, the justice holding that with the ownership of the land runs the proprietorship of the air, all the way up.

If this is the law no airship can fly beyond the range of its owner's realty without trespassing, unless he secures permission from all the land owners below. If the Punxsutawney farmer could forbid "stunt" flying he could probably forbid any sort of flying—for the air and all the rights and easements appertaining thereto are his to have and to hold as long as he pays his taxes.

Thus opens a new and interesting transportation problem. It may be necessary in the future for aerial passenger lines to buy franchises across the country, availing themselves of the right of eminent domain and condemning air lanes wherever they need them.

This will be expensive and a great incentive to "honest graft."

Franchises are not easily come by, as anyone knows who is familiar with the history of Tammany Hall. Already the members of that institution must be licking their chops as they gaze at the illimitable ether over New York and think what can be got out of getting options on it before they grant anybody any rights to send aeroplanes through it.

Transcontinental Air Mail

THE establishment of a transcontinental air mail service in 1921 was regarded as an extremely dangerous performance. The amount and variety of territory to be covered between our two coasts are great. Both the Rockies and the Sierras must be crossed, and there are only sixteen federal stations on the way. But the completion of a year of flying without a single fatality indicates that a transcontinental air mail service need not be any more dangerous than a transcontinental motor mail service. The mail-carrying aeroplanes last year flew 1,750,000 miles. That is the same as going around the world seventy times. It might be sad work counting motor accidents for such a distance.

Taxicabs of the Air

THE taxicab on land has vindicated itself by its convenience, cheapness and service. A somewhat similar system has already been started for air travel abroad. At the Croyden Air Station, near London, an aeroplane taxi, seating three passengers, is maintained ready for immediate flight, the rate being a flat charge of less than fifty cents a mile. A traveler on an eastbound ocean steamship nearing England can call one of these air taxis by wireless and find it waiting his arrival.

We in America are lagging behind Europe in aerial passenger traffic, but when we get our pace the returning American will find a plane cab or his private air car waiting for him on his arrival to whisk him through to his home in New England or wherever else it may be.

THE NEWS of THE MONTH

Air Mail Seattle to San Francisco Projected

Seattle.—Air mail service between Seattle and San Francisco within a comparatively short time was forecast by Colonel Henderson, Second Assistant Postmaster-General, who arrived with a party of Postoffice Department officials on a national tour of inspection. "The Seattle to San Francisco service depends on two things," said Colonel Henderson. "We must first secure favorable action on a bill now before Congress giving us the right to have mail carried by private contract, and we must demonstrate the practicability of flying at night. I believe both these contingencies will be in our favor."

Wants Air Station on Barren Island

Barren Island has been suggested as a site for the naval air station now at Rockaway Point by Judge Alfred J. Talley, of General Sessions, in a letter to Admiral Moffet, chief of the Bureau of Aeronautics. Judge Talley is executor of the estate of Andrew White, which with New York City owns practically the whole island.

The letter is in reply to a statement made by Admiral Glennon to the effect that the removal of the air station from Rockaway Point would place the city at the mercy of foreign invaders in case of war, and that there was no other point available for an air station. In his letter to Admiral Moffet Judge Talley said:

"May I not suggest that the dangers and difficulties occasioned by the action of the City of New York in relation to the air station at Rockaway Point can be avoided by establishing the station on Barren Island, which immediately adjoins Rockaway Point. Practically the entire island is owned by one private party and the city, and the unoccupied buildings could readily be made suitable to Navy uses."

In a letter to Admiral Glennon Judge Talley said:

"The plants formerly operating on Barren Island have been practically discontinued. The island is now connected via the Flatbush Avenue extension with the mainland, and the buildings now there could readily be converted to Navy uses."

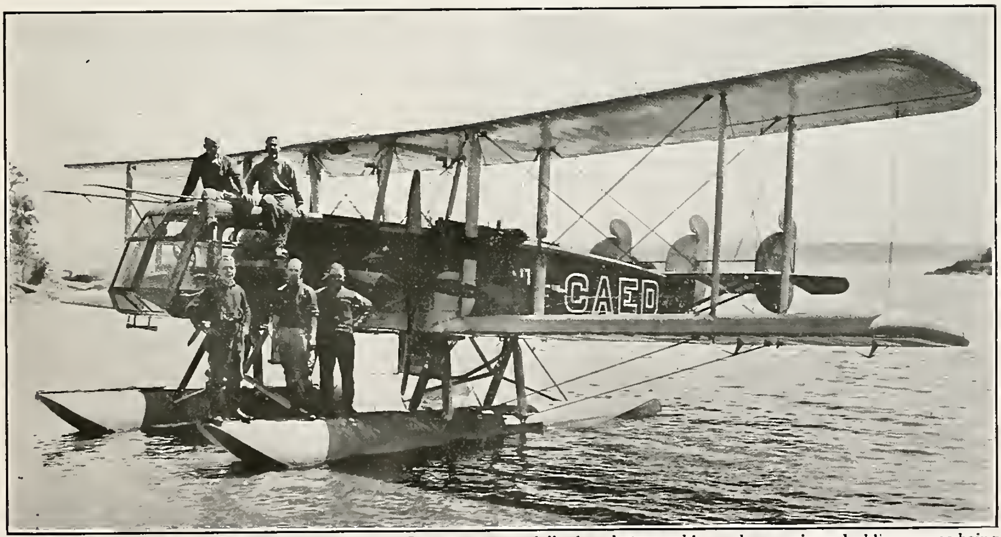
Barren Island was formerly used as a garbage disposal and dead animal rendering plant, but this use of the island ceased several years ago. The island is more than a mile long and half a mile wide. It is separated from Rockaway Point by Rockaway Inlet. Judge Talley also thinks that the island is so sheltered that aircraft could land and take off in the same waters they now use. He thinks that it has all the advantages of Rockaway Point and none of the disadvantages.

Aeroplane to Locate Alaska's Lost Lakes

Locating and photographing undiscovered lakes in the national forests of Alaska are the latest uses to which the aeroplane has been put, says the Forest Service, United States Department of Agriculture.

It has long been known that there are many lakes on the headlands and islands traversed by the inside passage between Seattle and Skagway that do not appear on any map. During the New York-Nome flight made by Army aviators, lakes were frequently sighted which could not be found on the latest and most authentic maps of the territory. Tales of unknown water bodies are constantly being brought in by trappers and prospectors. Less than a year ago a lake 4½ miles long and ½ mile wide was discovered at the head of Short Bay. This lake has over 1,000 acres of surface area and is less than 1¼ miles from tidewater, yet because of the surrounding country's rough topography has remained unknown and unnamed.

Recognizing that many other of these "lost lakes" may be sources of valuable water power, the Forest Service has laid plans to map this no-man's land of the north by means of aerial photographs. A few days' flight, it is said, will be sufficient to



The F.P.2 seaplane, built by the Dayton-Wright Company, especially for photographic work, mosaic and oblique, now being used by Walter E. Lees to make a mosaic of a thousand square miles of timber land for the Spanish River Pulp Co. of Canada. In the group are Walter E. Lees, pilot; Milton S. Beal, and J. R. Doty, camera men; Arthur Hayden and William Whitman, mechanics cover the area with a degree of accuracy that would require many years and great expense to accomplish by ordinary methods.

The work, which has been approved by the Federal Power Commission, will be done by seaplane, flying from Ketchikan as a base.

The American Entries in the French Gliding Contests

The first successful gliding tests to be held in the United States since the Wright Brothers' experiments, which ended in 1903 with the world-famous initial flight of a motor-driven aeroplane, were announced today by the Aeronautical Chamber of Commerce of America.

The experiments were made on June 12th, at Ipswich, Mass., by three students of aeronautics at the Massachusetts Institute of Technology, Cambridge, Mass., who sail Saturday on the French liner La Savoie, to participate in the First International Gliding Contests, to be held August 6th to 22nd, at Clermont-Ferrand, France.

The participants on behalf of the Aeronautical Engineering Society of the Massachusetts Institute of Technology, are: Edmund T. Allen, age 26, of Chicago; Harry C. Karcher, age 20, of Mansfield, O., and Otto C. Koppen, age 22, of Mamaroneck, N. Y. Mr. Allen, who was formerly a test pilot for the Army Air Service at McCook Field, Dayton, O., is the pilot. The chief designing work, with the asistance of the Aeronautical Society, was done by Mr. Koppen. Mr. Karcher had charge of the practical construction of the glider.

The entrance of the United States into the international competion in France marks a new phase in the development of American aeronautics, according to officials of the Aeronautical Chamber of Commerce. Germany, deprived of the privilege of orthodox engineering, after the Armistice, turned to motorless aeroplanes, and at a competion last Fall, distances as great as 15 miles were traversed by gliders. France was quick to arrange for a general contest and experimentation has been going on ever since in most of the large nations of the world. There probably will be three score entrants in the French affair.

Messrs. Allen, Karcher and Koppen constructed a glider at the M. I. T. laboratories and on June 12th, Mr. Allen took it to a 50-foot elevation at Ipswich, Mass. He rose in a fifteen-mile head wind. Altogether five successful flights were made. The velocity of the wind was such that the machine hovered practically the entire time. It reached a maximum elevation of twenty feet and advanced a maximum distance, in one flight, of 200 feet.

As a result of these trials, the young men, with the assistance of other aeronautical students at Cambridge, redesigned the glider into what they believe is the most efficient type yet produced anywhere in the world. The frail little aircraft, now stowed away aboard ship, has a span of 24 feet, a chord (or width of wing) of 4 feet 9 inches and measures 16 feet overall. It is of spruce and fabric construction and weighs but eighty pounds. The most successful of the famous German gliders weighs 149 pounds. Yet the Cambridge craft has a factor of safety of four. It is asserted by the builders that the craft has greater ease of control than the ordinary type of plane, having ailerons, rudder and flaps, the full length of the monoplane wing.

"The American aircraft industry will watch the results of the French competition with keen interest. The attention of the world is divided between the helicopter (machine capable of vertical flight) and the glider, or motorless aeroplane. Both have much to contribute, but the glider appeals probably more to sportsmanship. A great deal should be learned aerodynamically from motorless flight."

Notice to Aviators

At High Hill Beach, New York via Belmore, L. I., near U. S. Coast Guard Station No. 87, there is a large wooden platform painted green, with large white numbers 87 on the upper side. It is surrounded with green grass approximately two and a half to two feet in length, forming an apparently level surface of about one-half mile wide and two miles long. From the air this would appear to be an ideal landing field, especially as there is an indication that the numbers 87, but in reality it is exceedingly marshy and swampy ground, and should an aviator attempt to alight thereon there would undoubtedly follow some damage to the aircraft.

Correction

In our issue of August we stated that the flying field at Kansas City consisted of 53 acres, whereas as a matter of fact the field contains 153 acres, a portion of which has been leased to the Government. The contract for the erection of Government equipment has been let and the work should be completed sometime in October.

Aerial Mail Night Flying

Experiments have been made by the Post Office Department from time immemorial for the improvement of the mail service to the citizens of the United States, but never before has the Department been pushed to experiment above the clouds. It is all due to the fact that the Post Office Department is considering establishing night flying.

Flying by night means much more than flying by day. It means lighted fields. Also it means constant communication between the planes in flight and the stations. At Bolling Field, Washington, D. C., a mail plane has been fitted with both receiving and sending radio telephone apparatus for communication tests. During flights over the capital city above the clouds conversation has been maintained successfully with the radio telephone station in the Post Office Department building.

Just as ships on the ocean, without radio lose themselves if the sun and the stars are obscured, the ships of the air lose themselves. At night air mail planes without radio equipment would be very apt to lose their way, run out of gasoline and finally crash to the ground. The Post Office Department wants to establish good air mail service, but it insists that the service must be safe.

With radio telephone equipment, ships could be given their position in ten minutes or less, it is estimated by officials of the Air Mail Service. The operation would be something like this: An air mail plane flying at night would call for its position. Radio operators in the stations from which the plane departed and to which it was going, by means of rotating finder would determine the exact direction the message came from. One station would then report the angle to the other station. This operator would draw a triangle on a map from the information received. The plane, of course, would be at the apex of the triangle. The flyer informed of his position, could quickly make his way back to the route.

Radio will also be used to report ground conditions at the stations to planes in flight. If a heavy fog settles over San Francisco the flyer with mail will be warned to land some place else. The passenger and mail planes between England and France are equipped with radio sets for such emergencies.

Further experiments which will now be conducted by the Air Mail Service, look toward simplifying the radio equipment in order to reduce the weight. The air mail plane detailed at Bolling Field now carries radio equipment which totals about 200 pounds. It is believed this can be reduced at least one-half.

The mail plane reels in its experimental antennae like a fisherman reels in a trolling line. The antennae consists of a 300-foot copper wire which sails out behind the plane when in use, weighted by a little lead fish. Electric current to operate the radio telephone is manufactured by a generator run by a fan which spins at high speed as the plane rushes through the air. The radio receivers are enclosed in rubber cups to permit the pilot to hear the radio conversation above the roar of the motor.

Seaplane Mail Service

Sea plane mail service at New Orleans will be established soon, according to an announcement given out by the Post Office Department, in line with the policy to speed up mails at the chief American ports. The plane will catch outgoing steamers with late mail and bring in mail from the steamers half a day ahead of time.

Announcement is also made of the placing of sea posts on five Oriental steamers of the Shipping Board using the port of Seattle. Mail sorters on these steamships will sort the mail even down to carriers' routes for Seattle. At Victoria a sea plane will take the mail to the city 84 miles away and delivery will be made before the boat docks. At New York a special mail boat has been in service for some time taking off mail as the steamers arrive at Quarantine. A sea plane has been in service at Seattle for the period of a year and the results have been satisfactory. It was found, however, that to obtain the best service it was necessary to have mail clerks on the steamships.

A Plane Which Cannot Spin?

Is the Petrel, which is now under test at McCook Field by the Engineering Section of the Air Service, so balanced and designed that a tailspin is impossible? This question has come up during the tests, in view of the fact that no pilot has been able to make the plane spin.

This question has probably to do with the center of pressure travel on the Gottinenn 387 wing.

The plane has been flown by Captain McCready, by Captain Mosely, by Art Smith, by Meister and by Pat Moriarty, for the Army, and by Mr. George B. Post for Huff, Laland & Co., its manufacturers. It has been looped and rolled. It has been flown in mimic combat by Pat Moriarty against the Vought, and has been placed in nearly every conceivable position. But no one has been able to make the plane spin.

All of the pilots who have flown it have reported enthusiastically concerning its maneuverability and ease of control over a speed range of nearly sixty miles. It is quite sensitive to all controls, and very easily and quickly turned. But, evidently, the plane will not spin.

When placed in positions where it should stall, with the controls so placed as to drop the plane "into it," the Petrel seems to fall off its lower wing in a side slip, from which it will emerge in a dive if let alone. Further information on this feature of the plane will be very interesting, in view of the efforts which have been made to design a plane which cannot fall in a tailspin.

Aeroplane view of Utah Copper Co. mine at Bingham, Utah, showing system of surface mining by steam shovel on terraces. Forty thousand tons of ore per day are removed when this mine is working full capacity. Photo by Capt. Le Mar Nelson, U. S. Air Service, Salt Lake City

Goodrich Re-enters Aeronautical Field

The B. F. Goodrich Rubber Company has announced its intention to resume the development and sale of aeronautical rubber products. The company's activities in this direction will embrace every field of aeronautics, including supplies for both lighter-than-air and heavier-than-air craft.

It will be remembered that during the war Goodrich was very active in this field, producing various types of balloons and large quantities of tires and supplies for the government.

The present decision to resume aerial operations has resulted in the addition to the company's personnel of Mr. Henry Wacker. Mr. Wacker, an experienced and practical aeronautical man, was formerly connected with the Curtiss Aeroplane & Motor Corporation and more recently with the Aerial Mail Division of the Government Service.

The Goodrich Company's resumption of activities in this field is significant of its belief in the future of the aircraft industry. With the experience gained during the war period, the company is well fitted to continue the development of this line of industrial merchandise.

To Use Duralumin in Goodyear Ship

AKRON.—Dura'umin will be used in the construction of the new government semi-rigid dirigible, by the Goodyear Tire & Rubber Co. of Akron, aeronautical engineers of the company announce.

The ship will be the largest semi-rigid dirigible ever designed and constructed in the United States and will be 290 feet long, with a capacity of 700,000 cubic feet of gas. It will be designed and built to carry helium gas in place of hydrogen gas. The bag will be 71 feet in maximum diameter. The ship will be equipped with four Liberty motors and two propellers in conjunction with two reduction gears for the purpose of getting higher propeller thrust efficiency.

The keel of the ship will be entirely of duralumin. The keel will be of triangular cross-section running from nose to tail, with a large structural nose cone and fixed tail surfaces all built into the keel, the idea being that considerable support will be gained from this structural backbone of the ship, thereby reducing car flying pressures.

The ship will have two gas compartments and two air compartments. It will have a speed of 70 miles an hour and will carry 15,000 pounds of gasoline.

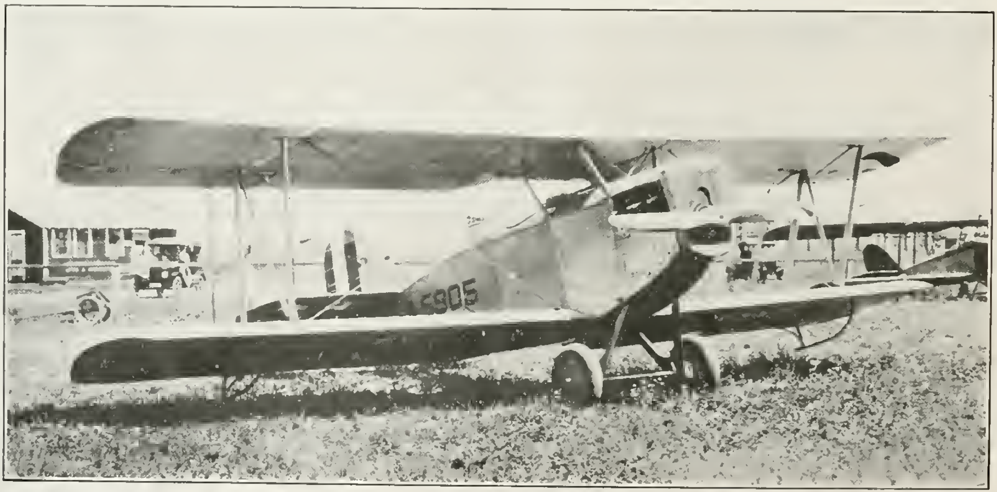
The ship will have a crew of 12, with complete facilities for carrying 20, including six sleeping bunks, electrical cooking facilities and many of the conveniences common to modern ocean-going vessels. It will carry three cars—the forward one being 50 feet long and 8 feet wide. The two power cars, each equipped with two Liberty motors of 400 horsepower each will be 20 feet long and 6 feet wide. All cars will be constructed entirely of duralumin members covered with duralumin sheeting. The total horsepower will be 1600. The motors, however will be throttled to reduce this to about 1200 horsepower for the purpose of increasing the durability of the engines. Facilities will be provided for free communication between the three cars through a passageway through the keel of the ship.

Means of getting on top of the huge gas bag will be provided through a vertical shaft 70 feet long, and a machine gun will be mounted on the top of the envelop to assist in protecting the ship during flight. Three other machine gun nests will be located in the lower part of the ship.

Grover C. Loening's Message to Aeronautic Executives

At the luncheon of the Aeronautic executives held at the Automobile Club of America, on July 12th there were present a great many of those who form the nucleus of the largest aircraft companies in the vicinity of New York.

In the spacious, airy banquet hall adjoining the library was set the luncheon table. Just behind the speaker's chair, raised on a small plat-



The Elias EM1 Expeditionary interchangeable land and water biplane form stood the radio receiving set. Sharp at one o'clock by Washington time via the radio the luncheon began. During the course of the first half-hour thereafter, the weather reports came in, followed by wireless music.

It was sincerely regretted by those present that Colonel Henderson was unable to attend; but according to the telegram read by the chairman, R. R. Blythe, he was unexpectedly called to the Pacific coast owing to the crisis of the railroad strike. R. R. Blythe stated that the succeeding luncheon would be held when Colonel Henderson was available to speak.

Grover C. Loening, president of the Loening Aeronautical Engineering Corporation, president of the Aeronautical Chamber of Commerce and well-known authority in aviation was introduced by the chairman as the speaker.

"Gentlemen, there is one vital message which must be conveyed to every one in aviation and to all others who are interested in aviation and to the public in general; and that is, that America leads the world in aviation.

"This is not a statement brought up by heated argument but one that is conveyed by cool judgment. We have here in the United States every world air record except the one-half kilometre speed record! This in itself is proof enough that our planes are the leaders of all other countries.

"The general opinion of everyone is that America lags in aviation. We must combat this viewpoint with the conclusive facts that we lead the world. We have no Government subsidies to pay half our passengers' fare, we are breaking in from the solid rock foundation and yet with all we have done there are many who say that we are behind Europe.

"Compare the number of passengers carried, compare the miles flown. United States so far has equaled or exceeded Europe in both the number of passengers carried and the miles flown.

"It means bank credits, and public confidence when we ourselves know and can feel the security that we do lead in aviation. It is one of the most vital things that we have to overcome today," said Mr. Loening. "We must have the self-assurance that we are on the winning side and going ahead. First convince yourselves and then in the expression of today—'You tell the world.' "

Plans to Center Aircraft Industry in Illinois

Seventy-two leading business men, including manufacturers, bankers and merchants, held a meeting in the office of Mayor Thompson of Chicago, July 29, to make plans for landing the aircraft industry for Chicago.

Illinois lost the automobile industry because the people were not so active as the enterprising citizens of Detroit. If they can secure the aircraft industry—make Chicago the center of the aeronautical business of this country—they feel they will wipe out the motor car deficit.

"Chicago lost the automobile industry to Detroit," said the mayor. "As a result, Detroit has grown from a sleepy old town of a quarter of a million people to a population of approximately one million, gaining enormous wealth. Detroit today is bragging that she is going to overtake Chicago in population. The aircraft industry has arrived at a point where it is about to experience great expansion and prosperity."

Charles S. Rieman, president of the Chicago Aeronautical Bureau, which is conducting the active campaign to make Chicago the center of the aircraft universe, said:

"The country's leading transportation authorities—heads of big railroads and steamship lines—predict that the next few years will witness such an increase in air transportation that it will become one of the principal forms of industrial activity.

"Chicago now has no facilities for the manufacture and operation of aircraft, but by promptly supplying suitable landing fields and manufacturing sites, many young companies can be induced to move their factories to Chicago. If we wait until they have grown and established themselves elsewhere, we will lose them. Now is the time for Chicago to take advantage of her opportunity."

Ralph C. Diggins told how the company of which he is the head had made more than 15,000 flights in Chicago during the last year without a single serious accident. William P. MacCraken, Jr., chairman of the Committee on Aeronautical Law of the American Bar Association, urged adequate landing fields.

J. F. Cornelius, vice-president of H. O. Stone & Company, said that Chicago had been designated as the headquarters for the transcontinental air mail service as one result of the activities of the Chicago Aeronautical Bureau. A large sum of money was being expended to make the Chicago Air Mail landing field one of the finest in the country.

Mr. Cornelius then outlined the plan of the Chicago Aeronautical Bureau for making Chicago the center of the aircraft industry, as follows:

First: To bring to Chicago practically all of the people engaged in aeronautical activity in this country, in order that we may convince them in a wholesale way that Chicago is the best place in America in which to manufacture aircraft and from which to operate the air transportation lines.

At the conclusion of Mr. Cornelius' remarks, John M. Glenn, Secretary of the Illinois Manufacturers' Association, and George B. Foster of the Commonwealth Edison Company both expressed hearty approval of the purpose and plans of the Chicago Aeronautical Bureau, and upon motion of Mr. Glenn, seconded jointly by James S. Agar, president of the Agar Packing and Provision Company, and Robert M. Birck, president of the Cleaners' and Dyers' Association, the following resolution was unanimously adopted:

That it is the sense of this meeting that we approve the plans of the Chicago Aeronautical Bureau to make Chicago the center of the aircraft industry, and that immediate action be taken to provide the necessary funds.

The Chicago Boosters' Club headed the list with a subscription of $5,000.

Florida Aviators to Make Cross-Country Flight

Mr. H. E. Cornell, vice-president of Glen Saint Mary Nurseries of Winter Haven, Fla., very well known all over Florida for his interest in the development of the citrus industry; Mr. George W. Haldeman, ex-Army officer, member of Aero Club of America and Aerial League of America, president of the Inter-City Airline Corp. of Lakeland, Fla., well known in exhibition work over the Southern States for the past three years, having filed exhibition contracts at most of the largest fairs in the South.

Cornell and Haldeman left Lakeland, August 7th, at noon, by train arriving in Dayton, Ohio, August 8th, where they have purchased a new high-powered commercial aeroplane of the Johnson Aeroplane & Supply Company of Dayton. The machine is powered by a 225-h.p. Benz motor and carries a gas supply of ninety gallons, capable of about six hours' flying. Her average speed is approximately 120 miles per hour.

Messrs. Cornell and Haldeman declare that they are not intending to break any cross-country flying record but are merely taking a 7,000-mile pleasure trip by air. Their new plane has been christened the "Skylark."

The start in their plane will be made at Dayton, Ohio, their course taking them through St. Louis, Kansas City, Denver, Salt Lake City, Boise, Idaho, and Walla Walla, Wash., which is their destination going out, Mr. Cornell expecting to visit for some time there with his brother, W. B. Cornell.

En route to Walla Walla the aviators expect to stop at McPherson, Kan., Mr. Haldeman's old home, where they will visit for a few days. They expect to make several side trips from Walla Walla, one of which will take them to Seattle, Wash., on the coast, from where they will start their return trip. The return will be made over a northern course, through Montana, North Dakota, Minnesota, Wisconsin, Chicago, Ohio and Pennsylvania to New York City. Here the aviators expect to spend about a week.

From New York they will return to Florida via Washington, D. C.; Newport News, Va.; Wilmington, N. C.; Savannah, Ga., and Jacksonville, Fla., bringing their trip to a close at Winter Haven, Fla., Mr. Cornell's home.

Mr. Cornell has for the past year been flying with Mr. Haldeman on business trips around Florida and during the past sixty days has completed a course of instruction of one hundred hours in the air, having as his instructor Mr. Haldeman, who has approximately two thousand flying hours to his credit.

After learning to fly Mr. Cornell was so impressed with the safety and practicability of the aeroplane that he decided to purchase a higher powered machine, and, together with Mr. Haldeman, tour the United States.

Plans of the International Manufacturing Co. of Los Angeles

The development of Airway Load Carriers by the International Transportation & Manufacturing Company of Los Angeles, is a new step in the effort to provide commercially efficient aero transportation. The Airway Load Carrier is designed, in a sense, as a combination of heavier-than-air and lighter-than-air principles, but its originators assert that it is distinctly a third type of aircraft.

The development was reached through several years of preliminary work and testing by the Hall Aeroplane Company, a California corporation, capitalized at $500,000. Most of this work was done at Los Angeles and Berkeley, California. The prime mover in this development is Charles S. Hall of Los Angeles, formerly an automotive engineer, and associated with him are G. B. Hannaman of Auburn, California, and D. Nelson Clark, of Long Beach, California, and a number of other Western men who are interested in aeronautics. Mr. Hall began the development of propellers after some years of study of propeller efficiency and has obtained patents on an entirely new type known as the "Hall helicoidal propellers," in which efficiency begins at the hub through special arrangement of a helicoidal projection. Tests of this propeller have demonstrated unusual efficiency and very quick "bite" of the air when the propeller is started. This feature was sought by Mr. Hall to bring about an efficiency desired in the handling of large aircraft, especially in taking off and alighting. It is also utilized to give an increased lift by using Hall propellers on a newly developed application to heavier-than-air craft.

The development of plans for the production of Airway Load Carriers has been very thorough and has taken four years of constant experimenting and research. This has been carried on alike from the engineering and commercial viewpoints, so that a system of tariffs and special marketing has been developed along with the plans for construction. As a result, the company begins its active work with an established method for determining the costs of operation and for practically laying out schedules and placing terminals and stations along with a system of calculating and undertaking the engineering features of construction.

Surveys which have taken a number of years have been made for routes and the establishment of landing locks and stations and radio compass stations across the country and into Mexico. The system of computing tariffs has received the assistance of traffic men and has also had the supervision of experts in other lines who have made sure that nothing was neglected in the plans. This has been followed by rigid cost analyses in which every charge—capital outlay, gross operating, etc.—has been taken into account and for which standards have been established for salaries, wages, depreciation, liabilities, damages, legal burdens, terminals and stations, subsidiary trucking companies, etc.

A method of mechanically handling the alighting of these craft and of locking them in loading stations and a very ingenious and rapid means of handling freight to give greater safety and expedition have been developed. The Company has acquired many basic patents and has others in the course of issuance on special features relating to the Airway Load Carriers and other aircraft accessories, and expects to have more than one hundred patents before completing protection on the essentials and accessories already developed. D. Nelson Clark, counsel for the Company has been spending the summer in Washington and New York, looking after patents and other developments.

Curranium gas is not owned by the International Transportation & Manufacturing Company, as has been stated, but is privately owned by individuals, and no stock relating to its production is on the market. The owners of Curranium and Dr. Curran are interested, however, in the International Transportation & Manufacturing Company, and that concern holds an option on the use of the gas in aircraft work following its production.

The International Transportation & Manufacturing Company will construct Airway Load Carriers of moderate capacity at the outset and put them in a combined freight and passenger business. The first fleet will probably have no carrier of more than eighteen tons pay-load capacity. The cost analysis of operation of these craft are, at present, based upon the use of Liberty engines, although Mr. Hall and his associates believe that the larger load carrying aircraft must sooner or later come to a more efficient means of power than the internal combustion engine.

The International Transportation & Manufacturing Company is capitalized for $2,500,000. It maintains general offices at Suite 824-827 San Fernando Building, Los Angeles, but expects to establish its initial factory at San Diego, where land has been acquired for that purpose.

ARMY and NAVY AERONAUTICS

Air Service R. O. T. C. Summer Camp Opens at Kelly Field

The Air Service R.O.T.C. Summer Camp, under the command of Major C. W. Russel, A. S., (D.O.L.), opened at Kelly Field on June 15th with sixteen Texas A. & M. College students in atendance. It was originally planned to have about thirty students at the camp this summer but, due to the rigors of the 609 (physical) examinations for pilots, the remainder were disqualified.

The course of instruction is very practical, and is being made as comprehensive as possible for the six weeks' duration of the Camp. Theoretical instruction is being reduced to a minimum, due to the fact that this has been largely covered during the students' course at College. The mornings are devoted solely to flying, while the afternoons are given over to necessary lectures and conferences on the next day's missions. Instruction and practice is being given in every phase of back seat work.

The students are all very enthusiastic about the flying game, and will undoubtedly prove consistent boosters for the Air Service.

Engineering Men Visit Chanute Field

The Society for the Promotion of Engineering Education, consisting of professors and instructors in Engineering and Mechanical Work from the various technical schools and universities in the United States, were guests at Chanute Field, Rantoul, Ill., recently. A special car brought the visitors to the field, where they were conducted in small parties through the Air Service Mechanics School by the officers, noncommissioned officers and civilian instructors. Each party visited each course of instruction in operation, which was explained very carefully by the guide.

At the completion of their tour of the departments and hangars a flying exhibition was given to afford the visitors an opportunity to study the various types of aeroplanes in use. The aeroplanes were DH4B's Fokker, SE5's, and the T.M. Scout. The visitors expressed themselves as greatly pleased with the afternoon spent at the field and at the manner in which the training of mechanics is being conducted at this school.

Bombing Maneuvers at Galveston, Texas

A crowd, variously estimated between 25,000 and 50,000 people, witnesed the bombing of the schooner *Navidcd* off Fort Crockett, Galveston, Texas. The seawall was black with spectators and cars were parked wherever room was obtainable. From a tactical standpoint, the exercises were a marked success. Those who knew what it was all about had ample demonstration of what the Air Service, properly equipped, can do to ships at sea, and the pilots who took part are entitled to the satisfied smiles they are wearing. All of the bombing was done with dummies of tile, since the live bombs obtained could not be

Construction frames of the giant dirigible ZR1 at the Naval Aircraft Factory, Philadelphia

The U. S. S. Wright fleet tender for the Atlantic Fleet Air Squadrons

used in racks of the type with which the ships are equipped. Even so, the last attack left the *Navided* on fire in the hold, to burst into flames upon the withdrawal of the planes. The opening attack was made with two 5-ship formations of SPAD XIII's dropping four 25-pounders and getting a very creditable percentage of hits on deck, in spite of the fact that the minimum altitudes for live bombs were adhered to. The SPADS were followed by a formation of five DH4B's from Kelly Field dropping full loads of 25-pounders.

It was obvious to any observer that, if bombs of the types ordinarily used against craft of this type had been employed here, every seam in the hull would have been wide open to the sea after the DH's were half through. This attack was followed by two formations of SE5's dropping 4 bombs each, 3 of the planes remaining to attack with machine guns.

The First Pursuit Group expects to have more of this sort of thing at Selfridge Field, the unused shallow portions of Lake St. Clair offering a convenient location for either practice or demonstration.

Opening of R. O. T. C. Students' Camp at Mitchel Field

The R.O.T.C. Student's Camp for the 25 students of the Massachusetts Institute of Technology officially opened at Mitchel Field, L. I., New York, on Monday, June 19th. The students arrived June 15th, and were immediately quartered in barracks previous provided for them. The mess was opened and camp routine fully established in order that the schedule of instruction might start promptly at 8:00 a.m., Monday, June 19th. To date the schedule as previously submitted for this camp has been carried out fully. There have been interruptions in the flying portion of the schedule due to inclement weather. This, however, has been made up in the afternoons and on Saturdays. The students are receiving on an average of one hour of flying per day. No pilot instruction is, of course, being given them, but they are being given flights in connection with the instruction in photography, aerial observation, map making, etc. The school is operating more smoothly and harmoniously than was anticipated. It would appear from reports that the students are enjoying the course and are finding it very instructive. In order to carry out the program, eight aeroplanes are being detailed daily to the duty of flying these students.

Eberts Field Reunion

There will be a reunion of the men who were at Eberts Field, Lonoke, Ark., during the war on September 21-23 inclusive. Headquarters have been established at the McAlpin Annex, formerly the Martinique, New York City, and complete information can be had there from Lt. J. E. Bullock. An excellent program is being arranged and it is hoped that every man who trained at Eberts Field will respond.

Army Flyers Make 122 Miles an Hour on Overland "Hop"

Washington.—Lieut. James H. Doolittle and Leland S. Andrews, Army Air Service, flew from Kelly Field, San Antonio, Tex., to Bolling Field, Washington, a distance of 2,080 miles, in eighteen hours.

This announcement was made by the War Department. The fastest time made by Doolittle and Andrews was when they flew from San Antonio to Jacksonville, Fla, with short stops at Houston, Tex., and Pensacola, Fla., a distance of 1,220 miles, which was made in ten hours' flying time, an average speed of 122 miles per hour.

They flew from Jacksonville to Washington, a distance of 860 miles, with a short stop at Langley Field, Va., in eight hours.

Night Flying Tests

Further experiments in night flying by the Post Office air service will be started at the McCook Field, Dayton, Ohio, to supplement tests being made in radio communication at Bowling Field, Washington.

A mail aeroplane has been ordered transferred from the Chicago station to Dayton, where the experiments will be pushed ahead rapidly. Under the direction of army experts in night flying this plane will be provided with searchlights and other necessary equipment for flying in darkness, after which actual flights at night will be made.

At the present time there is only one other aeroplane in the United States equipped for night flying. It is at the McCook field, Dayton.

REVIEW of WORLD AERONAUTICS

New British Air Service

The British Air Ministry announces:—A scheme for the establishment of air services between Southampton and the French ports of Cherbourg and Le Havre has been approved by the Air Ministry. The services will be operated under the general terms of the subsidy scheme made public in June of last year.

A new company, probably with the title of the British Marine Air Navigation Company, Limited, is being formed to operate these new services, and in addition to the promoting company certain shipping companies will be financially interested in the scheme.

These services mark an important stage in the development of commercial aviation as the company will use, for the first time, marine aircraft designed and built by the Supermarine Aviation Works, Limited. The existing British services use land types of aircraft only. The need for establishing services using this type of aircraft was emphasized in 1919 in the Report of the Advisory Committee on Civil Aviation.

The main object of the scheme is to shorten the Cross-Atlantic journey by picking up passengers from Cherbourg, conveying them rapidly by air to Southampton, and thence onwards to London by train. In addition, the company intend to operate a Southampton-Le Havre service in order to speed up travel on the Cross-Channel section between London and Paris for passengers proceeding by this route.

In both these schemes the company has the active cooperation of the London and South Western Railway Company in connection with through bookings between the terminal points on each route.

Subsequently it is proposed to operate a service betwen England and the Channel Islands for passengers, produce, newspapers and mails. This air service will also reduce very greatly the time taken between the Islands and the mainland.

The company will receive a subsidy of 25 per cent on the gross earnings from the carriage of passengers, goods and mails, and also a payment of £1 10s. per passenger carried and 1½d. per lb. of goods carried. The latter payments are half the sums paid to approved companies operating the London-Paris air services.

The French authorities have been approached for the provision of the necessary customs facilities at their ports, and the French railway companies concerned are also assisting by providing suitable train connections on their part of the through route to Paris.

Saying It with Flowers by Air

Information that Dutch florists have adopted the expedient of sending their flowers daily to the London market by aeroplane has been received by the Department of Commerce from Trade Commissioner Howard W. Adams, The Hague. The flowers are cut at night, packed early the next morning, and sent by motor-car from the Boskoop flower growing district to the Waalhaven aerodrome near Rotterdam. They arrive at Croydon, England, at 1:30 P. M., and from there are despatched by motor-car to the London florists. Boskoop flowers are thus put on sale simultaneously in the London and Dutch shops. About 100 kilograms of flowers per day are to be transported in this way.

Navy VE7 seaplane leaving turntable catapault on the U. S. S. Maryland

Spain-Argentina Line

Washington.—A despatch received from Ambassador Cyrus Woods announces that an airship service across the Atlantic Ocean from Seville, Spain, to Buenos Ayres, Argentina, will be established.

The enterprise, Ambassador Woods states, is being financed partly by British capital. It is hoped to inaugurate a regular airship service within the next two years. Sites for aerodromes have been obtained in both cities and building operations are to start soon.

The airships to be used in the transatlantic service will be somewhat larger than the ill-fated R-38. They will be driven by nine Maybach engines, each of 400 horsepower. Four engines will be placed on either side of the ship, with one in the stern.

The plans call for cabin accommodations for forty passengers. Space for passengers is to be limited so that the major part of the carrying capacity can be utilized for the transportation of mails. It is proposed to establish a postage rate of 75 cents per letter, while $1,000 will be charged per passenger.

The cabin will be situated in the forward part of the hold and includes quarters for the ship's officers, a saloon, a kitchen and a smoking room. Space for baggage will be provided along the keel.

Traffic on Cross Channel Routes

The British Air Ministry announces:

The returns of air traffic on the Cross-Channel routes to Paris, Brussels and Amsterdam during the three months, April-June, are now available.

During this quarter 764 machines departed from the London Terminal Aerodrome, Croydon, and 768 machines arrived, the total number using the aerodrome on Continental services being 1,532. This is a considerable increase on the figures for the same period last year, when 506 machines departed and 495 arrived.

The majority of machines were of British nationality, belonging to the Handley Page Transport, Limited, the Instone Air Line and Daimler Hire, Ltd. The figures by nationality are: British, 915; French, 228, and Dutch, 189. Last year British machines numbered only 246 out of a total of 1,001 machines using the aerodrome.

The total number of passengers carried during the period was 3,128, and is a slight decline on the total of 3,565 carried a year ago. The proportion carried by British companies has, however, greatly increased, 2,402 traveling in British machines against 1,653 in the same period last year. British traffic, therefore, amounted to 76.8 per cent of the total, whereas last year it was only 46.4 per cent.

The total weight of goods carried by aircraft to and from Croydon was 144 tons, which is a large increase on last year, when the figure was 56.9 tons. Half of this total was carried by French machines, but the British share of the traffic shows the largest proportionate increase, 53.6 tons having been transported by British machines against 4.9 tons a year ago.

The efficiency of British air services continues to be of a high standard. In April the efficiency of flights made and completed within four hours by British machines on the London-Paris route was 92.3 per cent. For May the figure was the same, and for June it rose to 95.2 per cent. The figures for French machines during the same period on the same basis were: April, 71.3 per cent; May, 85.0 per cent, and June, 79.1 per cent.

Notwithstanding these figures it has to be noted, however, as stated in the last half-yearly report on Civil Aviation, that a considerable increase in traffic is essential if air transport firms are to obtain a commercial basis of operation, the passenger accommodation occupied on British machines being only 37 per cent in April, 30 per cent in May, and 31 per cent in June, and the useful cargo capacity used only 44 per cent in April, 44 per cent in May and 40 per cent in June.

British Air Council

An Order in Council to be published shortly by the British Air Ministry enacts that the Air Council shall consist of the following members:

One of His Majesty's principal Secretaries of State, who shall be president of the Air Council.

The Parliamentary Under Secretary of State for Air.

The Chief of the Air Staff.

Air Member for Personnel.

Air Member for Supply and Research.

The Secretary of the Air Ministry.

The main intention of the New Order in Council, which replaces that of October 13, 1920, is to redistribute the business of the Air Council and adapt the organization of the Air Ministry in such a way as to meet new requirements and increased responsibilities, and in particular to relieve the Chief of the Air Staff of some portions of the detailed administration of the Royal Air Force, which were previously under his direct control.

The main changes are as follows:

(1) The title of Air Member is given to each of the Members of Council serving in offices held by officers of the Royal Air Force, and the Chief of the Air Staff is described as the first and senior Air Member of Council and principal adviser to the Secretary of State in the direction of the Air Force.

(2) Subject to (1) above, the Air Member for Personnel will be responsible to the Secretary of State for the administration of business relating to the personnel discipline and organization of the Air Force, and the Air Member for Supply and Research (lately Director General of Supply and Research) will, in addition to the business already allocated to him under the previous Order in Council, be responsible to the Secretary of State for the administration of business relating to the equipment of the Air Force.

The Order also provides, having regard to the recent termination of the post of Controller General of Civil Aviation and its replacement by a post of Director of Civil Aviation responsible to the Parliamentary Under Secretary of State, that the Under Secretary of State shall in turn be responsible to the Secretary of State for business relating to Civil Aviation.

The Air Council, as reconstituted, is composed as follows:

Secretary of State and President of the Air Council, Capt. the Rt. Hon. F. E. Guest, C.B.E., D.S.O., M.P.

Parliamentary Under Secretary of State and Vice-President of the Air Council, the Rt. Hon. Lord Gorell, C.B.E., M.C.

Chief of Air Staff and Senior Air Member of Council, Air Chief Marshal Sir H. M. Trenchard, Bart., K.C.B., D.S.O., A.D.C.

Air Member for Personnel, Air Vice-Marshal O. Swann, C.B., C.B.E.

Air Member for Supply and Research, Air Vice-Marshal Sir W. G. H. Salmond, K.C.M.G., C.B., D.S.O., p.s.c.

Secretary, Sir W. F. Nicholson, K.C.B.

Circuit of Great Britain

For the King's Cup, which has been presented by His Majesty the King for a circuit of Great Britain by aeroplane, a number of entries have already been promised, including the following:

The Duke of Sutherland (president of the Air League).

Lieut.-Col. Frank K. McClean (vice-chairman of the Royal Aero Club).

Sir Samuel Instone (Instone Air Line).

Sir Henry White Smith (Bristol Aeroplane Co., Ltd.).

A. V. Roe (A. V. Roe & Co., Ltd.).

H. Scott-Paine (Supermarine Aviation Works).

A. S. Butler (de Haviland Aircraft Co.).

Brig.-Gen. J. G. Weir, C.M.G. (J. & G. Weir, Glasgow).

Col. M. O. Darby (Aircraft Disposal Co., Ltd.).

F. P. Raynham.

In addition to the above, Boulton & Paul, Ltd., of Norwich; Armstrong-Siddeley Motors, Ltd., Coventry; Gloucestershire Aircraft Co., Cheltenham; Aircraft Disposal Co., Ltd., Croydon; Handley Page Transport Co., Croydon; Fairey Aviation Co., Hayes, and Short Bros., of Rochester, are preparing machines for the race.

The race will be a handicap under the Competition Rules of the Royal Aero Club, and the King's Cup will be awarded to the entrant of the aeroplane which first completes the circuit of Great Britain of approximately 850 miles.

FOREIGN TECHNICAL DIGEST

The New B. M. W. Engines

The Bayerische Motor Works of Munchen have just produced two new engines of the well-known B.M.W. type, best known by the 185-h.p. engine used in making a recent "American" world's record for duration, and so largely used in recent German aircraft.

The new engines both follow the general arrangement of this well-known B.M.W. III.a type.

The engine here illustrated is the smaller of the two. It is rated at 120 h.p., develops 140 h.p. at 1,400 r.p.m., and has a very low fuel consumption for so small an engine. It is known as the B.M.W. II.

The second engine is rated at 240 h.p. and develops 260 h.p. at 1,400 r.p.m. Very great attention has been paid to the reduction of fuel consumption and it is said that it can run on 170 grammes (.375 lbs.) per h.p. hour. This figure sounds highly improbable—the guaranteed figure of 195 grammes (.43 lbs.) is sufficiently extraordinary. This engine—like the earlier 185 h.p. one—is of the super-compressed over-dimensioned type and maintains its full normal output up to an altitude of about 12,000 ft. Owing to the restrictions on the construction of German aircraft and engines, this type may not be manufactured in Germany at present, but doubtless steps will be taken to construct these engines in some other country.

Specification of the New B.M.W. Engines

TYPE B.M.W. II.

Normal power	120 h.p.
Full power (1,400 r.p.m.)	140 h.p.
Number of cylinders	6
Bore	120 m/m.
Stroke	120 m/m.
Weight, dry	210 k.g.
Fuel consumption per h.p. hour	230 g. (.51 lbs.)
Oil consumption per h.p. hour	12 g. (.026 lbs)

TYPE B.M.W. IV

Normal power	240 h.p.
Max. power (1,400 r.p.m.)	260 h.p.
Number of cylinders	6
Bore	160 m/m.
Stroke	190 m/m.
Fuel consumption per B.H.P. hour	195 g. (.43 lbs.)

Petroleum as Power Fuel for Aeroplanes

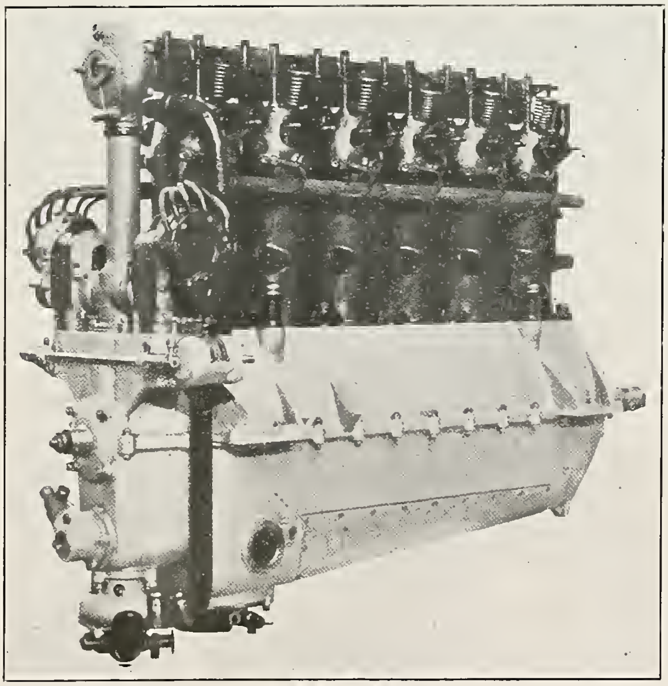
On the 5th of July in Seeland, from the airdrome of Lundteft, near Copenhagen, the first trip in the world took place with an aeroplane which used petroleum as power fuel, a proceeding which, apparently, signifies a landmark in the development of the flight and automobile service. It deals with a petroleum carburetor, an invention of the well-known Dane, Ellehammer. After tests having been made for some time past in the laboratory as well as with an automobile, the carburetor was placed in a Rumpler aeroplane with a 150-h.p. Benz engine. As power fuel ordinary petroleum was used, bought in a nearby shop at 25 cere per kg., while benzine costs 80 to 90 cere. After the petroleum had been poured into the tank, the Rumpler aeroplane went on its trip with flier Johansen for pilot, as well as a workmaster and a civilian flier as passengers. A number of experts were present at the test. It was evident that the engine ran satisfactorily in every respect. It flew just as well as with benzine; the vibration was less and not the least soot formed. There was consumed a smaller quantity of petroleum than of benzine. The carburetor used was only calculated for a 60-h.p. engine, whereas the engine in the aeroplane, as mentioned, was of 150 h.p. The only effect was that the engine had 100 revolutions less per minute; but, in spite of this, the aeroplane flew well. Formerly two ordinary benzine carburetors were used for the feeding of the six cylinders. On account of the result the Danish Air Navigation Company will operate their aeroplane engines with petroleum. According to the statement of the experts, the fuel burns completely, the danger of self-ignition is entirely done away with, as the new carburetor is a so-called dry carburetor. Smell and soot are absent. One may, after this—on account of the more diminished danger of ignition of the petroleum as compared with benzine, benzol, spirit, etc.—expect a revolution in aeroplane and automobile operation. England alone uses yearly engine benzine at a cost of £30 mill. Petroleum costs only one-third.

Meteorological Advice for the Air Traffic

By A. Schmauss—Munich

THE necessity of meteorological advice to the commercial flier is universally acknowledged. Even in the war, where little heed was paid to human life and material, as compared to the conditions of peace time, a wide-spread weather service was organized for the safety of the air service. It has acquired particular importance with the introduction of air traffic.

There are two ways to reach this end: a centralized service of safety and "information sources" organized in sections. Germany possesses so far only the first-



The New B. M. W. Engine

named part of the organization, the so-called "high strata" information of the Prussian Aeronautical Observatory at Lindenberg. In the early morning a selected series of suitably distributed post or telegraph offices, making use of a code prepared by the Observatory, report on the weather conditions of their localities and the state of the ground, either directly to Lindenberg or via a collecting center. At Lindenberg the reports are examined, supplied and worked out to a "line forecast," thus enabling aeroplanes, starting immediately after the Lindenberg wireless message, to be well informed about the first part of their flight. This supposes, though, that at the time of start there exists a receiver for wireless and specialists are at hand, able quickly to decipher that part of the naturally lengthy Lindenberg message, which is of importance for the respective line.

Now, such a centralized system would suffice if the weather would not change or if the meteorologist on service at Lindenberg was capable of forming a prediction of the coming changes. But this is not the case. If there is no possibility of one general weather forecast, made at one center for the whole of Germany, this is still less feasible with a weather service for air traffic, since the phenomena, of greatest importance for flying, such as fog or thunderstorms, are by nature local ones, and therefore require also an intimate acquaintance with the local conditions. A line may be blocked, according to the 7 A. M. message, by fog, the cessation of which might hardly be timed in advance by the resident observer. If the weather condition is one of "thunder in the air," the control station can hut give a warning of precaution, the influence of which on flying work will naturally diminish with growing distance from the service.

Thus we cannot do, in addition to the most serviceable centralized information service, without line assistance, which as yet is very backward in its organization. Let us take, as an example, the so-called "North-South Flight" Berlin — Leipzig-Furth—Munich—Augsburg. At 7 A. M. a number of post offices situated along this line report to Lindenberg (by indirect ways which may remain unmentioned), at 8.10 A. M. Lindenberg issued its statement for this line, together with the reports of the other parts of Germany. We assume that the flight control station at Furth and Leipzig furnish the pilots, starting at 10.15 A. M. for Leipzig and at 10.00 A. M. for Furth—both having to cross a bit of mountain country—with the deciphered data of the part of the wireless, concerning these intervals of the route. Will the pilot feel satisfied with these reports? No; they wish for fresher news and an expert's advice, if possible by word of mouth, particularly if atmospherical conditions of so quick variability are in question, as fog or tendency to thunder storms.

The central meteorological office of Bavaria has tried to fill up this gap by establishing a weather station on the Furth airdrome; but its future is not secured yet, from the financial standpoint, the air traffic companies refusing, to the general surprise, to contribute towards the expenses, though they have declared their readiness to cover the costs of the telegrams necessary for the centralized safety service. As it is customary that traffic lines have to bear all the expenses necessitated for their safety, the Air Companies held that the weather stations on airdromes should be supported by the State or the Community to which the airdrome belongs. We do not wish to discuss this controversy here and wish only to insist on the urgency of meteorological advice being supplied upon the airdromes. It will hardly enhance the feeling of safety on the part of the pilot if, instead of a line forecast issued hours ago at Lindenberg, he receives the advice of a meteorologist familiar with the details of the line, the latter one being able to inquire and receive, by means of the Lindenberg code, special information from particularly perilous portions of the line shortly before starting time a detail of special importance if this starting time had to be suddenly changed. As the flight is performed hy intervals, meteorological advice should also be given accordingly. Practicians may decide to which system they like to give preference; according to my war experience, to me the answer seems to be plain.

Naturally there is no need that such weather stations should do service exclusively for air traffic; if situated in university towns, they can well be annexed to the universities, thus enabling the latter to add to the lectures on meteorology, the practice necessary, and these weather stations might also, in the quality of local centres of forecast, furnish weather information and such like to the papers.

One more important question must be mentioned. How far should the pilot take the weather reports into consideration? First of all, it ought to be made a legal regulation that the pilot is obliged to personally read the weather reports at hand at every aviation field he touches. Practical America has understood it: the insurance companies there do not pay any premiums whenever an accident is to be attrihuted to the non-heeding of a weather report. To what extent the pilot will give heed to this report is, naturally, dependent on the degree of personal confidence he places in the meteorologist. I cannot approve of an air traffic company saying expressly in their report that on 10 days, for which the weather service had set the forecast "no flying weather," they have fully performed their regular flights. There ought to be a difference made between flying for the sake of sport and the working of a company to whom passengers confide themselves against a remuneration.

When selecting pilots, their meteorological fitness should be taken just as well into account as their technical ability. It should not be tolerated that a pilot should only be acquainted with his aeroplane; he ought also to be familiar with the peculiar properties of his fairway if the meteorological advice is supposed to be of real value.

A New French Flying Boat

On June 10th the first of the new three-engined flying boats intended for the service between Antibes and Ajaccio (Corsica) arrived at the air-port of Antibes. This machine, registered as "L.E.O.6," made the journey from Saint-Raphael, about 25 miles, in 22 minutes, in spite of very unfavorable weather, the pilot being M. Martin.

The machine loaded weighs 8,800 lbs. The central motor is a Salmson 260 h. p., and the other two are Hispano-Suizas of 150 h. p. each, or a total horse-power of 560. The pilot is housed in a small separate compartment by himself with the necessary instruments and wireless outfit, and below him is a spacious cabin seating six passengers. At two-thirds of its full power the speed is said to be 90 m. p. h.

The flying boat, which has been built by Les Etablissments Lioré-Olivier for the Cie. Aéro-Navale, which has the concession for the service between Antihes-Ajaccio-Tunis, was designed largely by M. la Barthe, a director of that line, and after thorough trials will commence its duties between the Riviera and Corsica, where the air traffic is already reaching considerable proportions.

New Fokker Plane Speedy

The Hague.—The Dutch aviator and inventor Fokker, who recently returned from his successful trip to the United States, has just completed two new commercial monoplanes for the Royal Dutch Aviation Company.

The trial flights proved that these monoplanes far surpassed the other Fokker models in efficiency and speed. They can carry a weight of 1,250 kilograms and can fly six hours without landing with six passengers and 200 kilograms of baggage, for which special space is allotted. They are fitted with a Rolls-Royce motor, making an average speed of 160 kilometers per hour.

One advantage of the model is that the whole nose, with the motor and screw, can be detached in a few minutes and replaced by another.

ELEMENTARY AERONAUTICS and MODEL NOTES

Model Aeroplane Club Activities in Chicago, Washington and New York

The National Scientific Society

THE attempt to form an alliance among the various model-aircraft clubs over the world for the purpose of compiling international standards so that competitions may be carried out on a recognized basis, appears to be heading towards success.

Besides having met with the hearty approval of many men prominent in American aircraft circles, the idea has been spoken of by organizations and individuals as one which bids fair to promote a growth of enthusiasm both among those interested in aeronautics and by the general public.

Having taken the initiative in working towards that goal, the Norsk Aeromodels Klub of Kristiana, Norway, and the Aeronautical Engineering Department of the National Scientific Society (of New York City), have already commenced to formulate laws which, upon completion, will be presented for the approval of those interested in international competitions.

Due to the various classes and kinds of models which have been constructed and presented at competitions, it has become necessary to divide the various classes into groups so that judgment could be rendered on a fair and impartial basis. The following table, having been used successfully by the Norsk Aeromodels Klub, has been approved by the members of the National Scientific Society and is presented to the Model Aircraft clubs for their approval. Suggestions are invited.

Classes	Construction	Hand Launch	Ground Start	Flying after a mark	Circling	Duration of Flight
A. Stick model to	100	40 *meters*	30 *m.*	40 *m.*	½ *Circle*	8 *sec.*
B. Scale model to	100	30 *meters*	20 *m.*	30 *m.*	½ *Circle*	5½ *sec.*

C. Free class.

Class A.—Rubber driven stick models. Standard type. Weight of rubber must no exceed 25 grams and rubber length must not exceed $\frac{\text{span .85}}{100}$

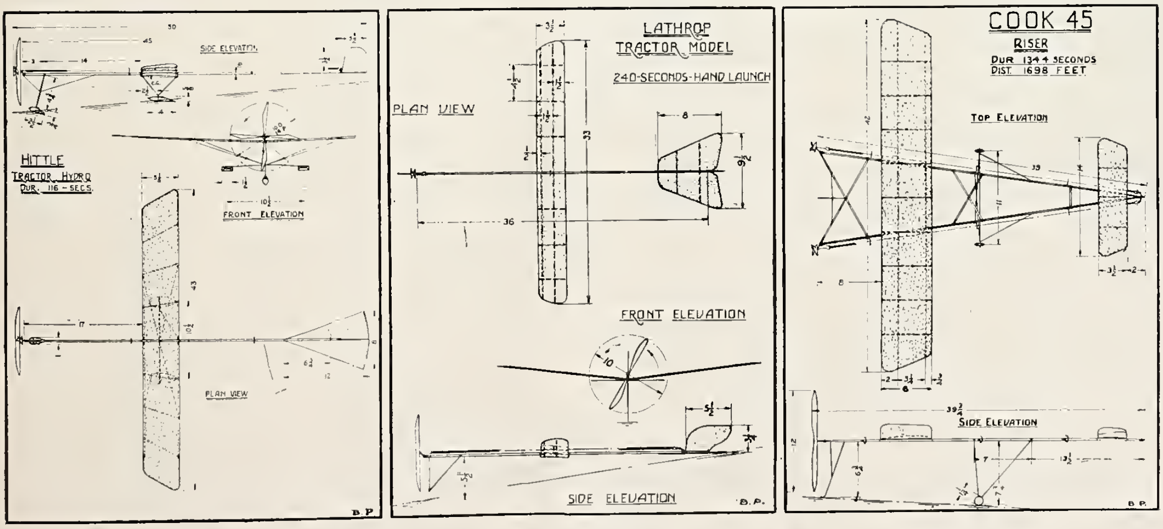
Class B.—Rubber driven scale models. Standard type. A stick in the fuselage wings or landing are mounted is not allowed. Weight of rubber must not exceed 25 grams and length of rubber must not exceed $\frac{\text{span .85}}{100}$

Class C.—Free Class. Record and other models. Power driven.

Points

1. *Construction.*—The model can be awarded up to 100 points for good construction, exceptional details, etc.
2. *Hand Launch.*—The model is launched from the hand with a slight push in the direction of flight. The Straight line between the starting point and the point where the wheels touch the ground is measured. The minimum yield is awarded 100 points, and each extreme meter is awarded 2.5 points (Class A) and 3.33 points (Class B).
3. *Ground Start.*—The model is started with a slight push. The model must take the air on a starting cloth measuring 5 meters in length. The distance measured is from the end of the cloth to the point where the wheels touch the ground. The minimum yield is awarded 100 points, and each extreme meter is awarded 3.33 points (Class A) and 5 points (Class C).
4. *Flying After a Mark.*—A circle with a radius of 5 meters is measured on the ground. The model is launched from the hand at a distance of 45 meters from the center of the circle. Landing within the circle brings 100 points. Each meter deficient, brings a deduction of 2.5 points (Class A). If the model is one in class "B" a distance of 35 meters from the circle's center is allowed, and each deficient meter brings a deduction of 3.33 points.
   (The Norsk Aeromodels Klub has chosen to measure to the point where the Model Stops). The National Scientific Society, in view of the fact that it is extremely difficult to control either a rubber power plant or a compressed-air plant to a definite pitch and time, has chosen to disregard the distance beyond the circle, in the case where the model has passed directly over it.
5. *Circling.*—The model is launched from the hand. The object is to have the model fly as many circles as possible. The minimum yield is awarded 100 points, and each extreme ¼ circle is awarded 25 points.
6. *Duration of Flight.*—Time is observed for the practises 2, 3 and 5, the longest duration being valid. The minimum yield is awarded 100 points, each extreme meter being awarded 12.5 and 20 points respectively for Class A and Class B. Time must be measured with the preciseness of 1/10 of a second.

The partakers may make two attempts in every practice and the best result is valid. The starting rules must be strictly adhered to. A faulty or incorrect start may be declared void. The models must not touch the ground between the starting and landing points. A landing must not assume the character of a down fall and circle flying should not degenerate into a spin. In the event that a model is damaged so that repairs are necessary, five per cent is to be deducted from the sum.



Three Record-Breaking Models built by members of the Illinois Model Aero Club, described in last month's "Aerial Age" of points. All the models in Classes A and B must be furnished with a secured landing-gear.

The foregoing table, compiled by Mr. Harald Gulbrandsen of Kristiana, Norway, applies to models of land planes only. No provision has been made for models of seaplanes or lighter-than-air craft. The members of the N. S. S. are drawing up a set of rules with which, it is hoped, contests for seaplanes and lighter-than-air craft will be encouragged. In the meantime, suggestions are invited. The headquarters of the National Scientific Society are located at Cooper Union, New York City. Mr. J. J. Kuscher is the president.

The Capitol Model Aero Club

Three contests have recently been held by members of the Capitol Model Aero Club at Washington, D. C. While no extraordinary records have been made, the work of the club members has been progressive and is an indication of interesting developments and further progress.

The address of the club has changed from 1726 M St., N. W., to 1210 18th St., N. W., at which place the members have an interesting and comfortable room. All aeromodellists residing in or around the Nation's Capitol are invited to membership.

Mr. Paul Edward Garber is the president of the C. M. A. C. Mr. Garber is connected with the Division of Mech. Tech. at the Smithsonian Institution, United States National Museum, Washington, D. C.

The Rubber Elastic Motive Power for Models

The use of rubber elastic for the motive power of flying model aeroplanes dates back before the first real flights of man. Choice was not made without good reason, for tests in comparison with all other known sources of power for models placed rubber at the head of the list.

First, let us consider its cost—a really important item, especially for the young experimenter. Compared with the simplest kind of engine, the cost is insignificant. As far as its efficiency as a power-medium is concerned, rubber can absorb a far greater amount of energy, for the same weight of material, than spring steel because of its greater extension. The handling and "upkeep" of our rubber-motor is extremely simple and economical.

As this source of power has become so widely used, it is well for our experimenters to learn more concerning its natural and mechanical properties, just as the good pilot knows all about the engine he depends on.

Crude rubber is obtained from a large number of different trees, vines and shrubs growing in Mexico, Africa, Java, Sumatra, India, Central and South America. The trees are "tapped" or cut, allowing the milky fluid, called latex, to flow in much the same manner as maple sugar is obtained from the trees in Vermont.

The rubber itself is obtained from the latex by the coagulation process, the principal materials employed being alcohol, acetic acid, air, alum or lime.

Rubber thus obtained in the crude state is purified from mechanical impurities by washing and drying processes, and its preparation for commercial purposes necessitates the use of filling materials called "fillers." The usual fillers employed are, sulphur, resins, oils, tars, whiting, white lead, talcs, barytes, and clays. Such fillers are used so as to reduce the cost of the rubber without affecting its mechanical properties or usefulness.

Pigments are used in the fillers of colored rubbers, amongst the most used being: lithopone, vermilion, zinc yellow, lamp black, iron oxide, antimony, arsenic and mercuric sulphides, graphite, etc.

Practically all of the commercial rubber is prepared by the vulcanization process, in which the pure or crude rubber is mixed with sulphur and subjected to either heat, acid or cold vulcanization processes.

Crude rubber is a tough, flexible solid, influenced by small changes of temperature, and becoming "tacky" at fairly low temperatures. It melts at about 250° F. and becomes a liquid which does not harden again on cooling. Crude rubber will not dissolve in water or alcohol but dissolves in dilute alkaline solutions, turpentine, petroleum spirits, carbon disulphide and carbon tetrachloride (commonly used in hand fire-extinguishers). Crude rubber is subject to oxidation and it becomes hard and brittle under the prolonged influence of air and light.

Many vulcanized rubbers are affected by the atmosphere and by the action of oils, alcohol, gasoline, etc. They are best stored in a dark place, freely covered with french chalk.

The best grades of rubber have a tensile strength of about 2,000 lbs. per square inch and an ultimate extension of about six times the original length. Good vulcanized rubber can absorb from 500 to 1,000 foot pounds for each pound of its own weight, whereas steel can only absorb from 10 to 20 foot pounds per pound of weight. From this it will be seen why steel springs can never compare with rubber as a source of motive power.

Flat strands of rubber, ⅛ inch wide and about 1/32 inch thick are the most popular size used for models. It is usually of very good quality, and a piece one foot long may be stretched to seven feet without breaking, after which it will return to its original length.

Increased Lift Obtained with Curved Wing-Tips

An appreciable improvement in lift and "lift-over drift" may be effected over that of the plain rectangular plan-form of wing with parallel section, by suitably shaping the plan form. The end losses due to "inflow" near the upper-surface wing tips and to "outflow" near the lower-surface wing tips may be reduced by suitably rounding off the wing tips, in plan form, and by thinning the wing section (or "washing out") in the front elevation.

The most beneficial effects, however, are obtained only after careful study of the distributions of air pressure and the employment of proper methods of grading in camber, chord and incidence. The coefficient of drift may be reduced considerably by "washing out" the wing tips.

An examination of the wing forms of fast flying birds reveals the fact that they are graded down to very thin pointed sections at the tips. The incidence angle at the tips is usually either zero or negative in value.

Wind tunnel tests on the effect of the shape of wing tips show that the most efficient tip is in the form of a semi-ellipse. For the most part it is undesirable to have as long a tip as is necessitated by an ellipse, and a semi-circular shape is used to good effect.

Design of Boat Hulls and Floats

Flying boat hulls are designed on the general principles of the fast motorboat and hydroplane, the main object being to "hydroplane," as distinct from ploughing, at as low a water speed as possible. The hull should offer the smallest resistance to water friction and the minimum of wind resistance when in the air. It should be stable, relative to the rest of the machine, when floating, when hydroplaning during the take-off, during alighting and when in the air.

Boat hulls or seaplane floats, aside from the considerations of total lightness of the machine, should be light in weight so the center of gravity will not be too low. A low center of gravity makes a machine very unstable in the air and is difficult to balance at all times.

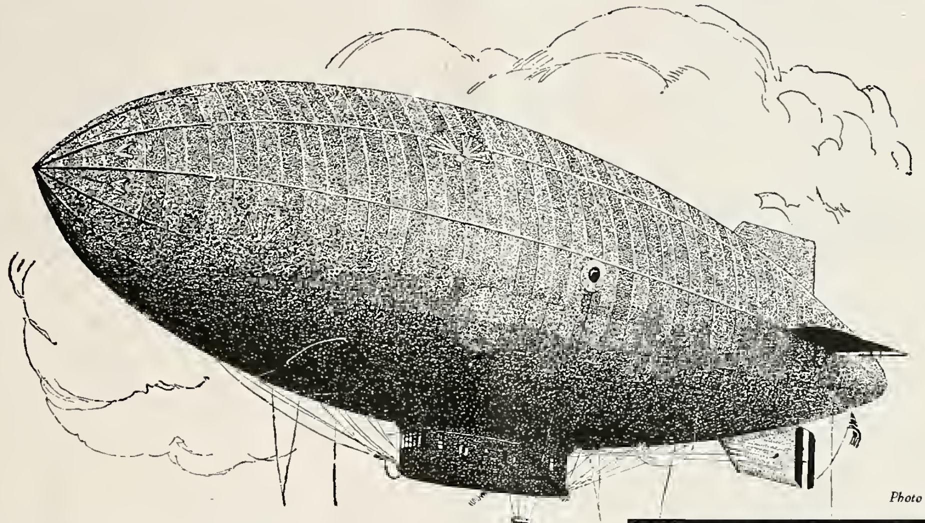
The hull of a flying boat or the floats of a seaplane should be designed for from 2 to 3 times the weight of the machine ready for flight.

Small Balloons Used to Record Temperature of Altitudes

Pressure and temperature measurements of the upper air are made with sounding balloons, which are small balloons inflated with hydrogen and which carry recording instruments. These balloons are arranged to burst at given altitudes, the envelopes acting as parachutes, breaking the fall of the instruments, so that they reach the ground without injury. An addressed label attached to the instruments offer the finder a reward for its return.

Sounding balloons average from 40 inches to nearly 80 inches in diameter. They rise under the influence of their buoyancy and on account of the diminished external pressure, burst at the altitude determinated upon beforehand.

In this manner records have been obtained for altitudes up to 23 miles, over 121,000 feet.



The latest addition to U. S. Army Dirigible Fleet measures 170 feet long and has a cruising radius of 20 hours, at 65 miles per hour.

Photo by Goodyear News Service

The Goodyear AC—

A New Type, Non-Rigid Dirigible

Test flights proved that the unusual contour of the Goodyear A.C., best described as "Squat," was fully justified—the lift of the ship was remarkable, her speed was more than satisfactory.

Concerning the varnish protection given various surfaces of the ship against weather, its makers, the Goodyear Tire and Rubber Company, have this to say:

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>
> "Army and Navy Specifications call for 'Valspar' or 'Equal', and we consider 'Valspar' to be the best varnish for this work. In our long experience as pioneers in the building of airships for both branches of Government Service we have never had a varnish defect, and we attribute that to our use of 'Valspar.'"

Valspar was used on the fins of the Goodyear A. C. and on the exterior and interior of the car, including the aluminum tanks, the fixed and movable control surfaces, instrument board and all metal parts. Durable, waterproof, flexible—Valspar protects wood and metal surfaces from water and weather, vibration, heat and cold.

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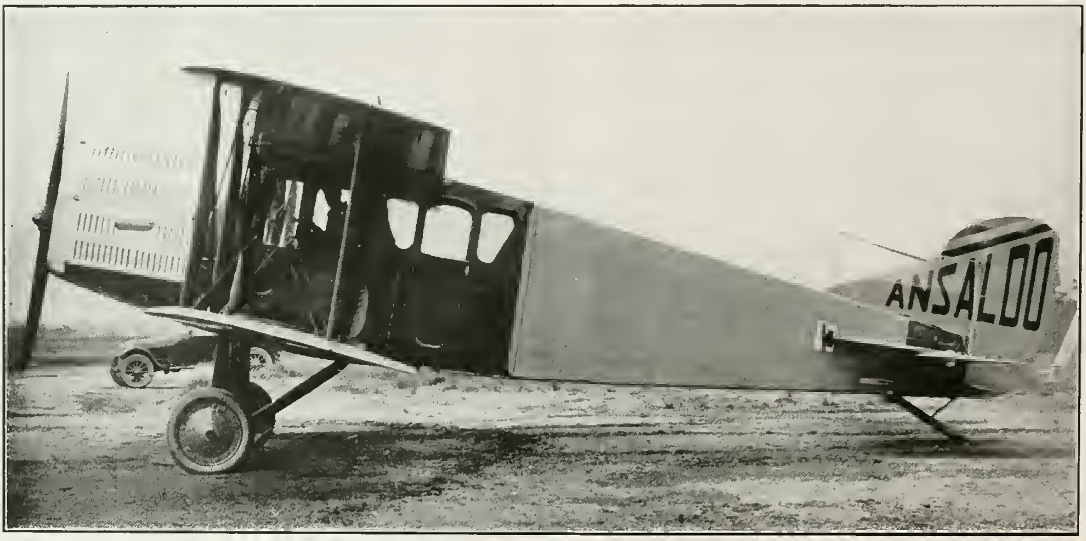

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The PETREL has been a gradual, certain evolution. During nearly two years of its development careful selections and alterations have been proved by test, and have brought it to its present state of high efficiency.

The PETREL is manufactured by workmen old in the best traditions of aircraft production, and proud of their craft. Every smallest part is selected from the same source, and worked on the same benches, by the same hands, which construct Huff Daland aeroplanes for Army and Navy, under direct government inspection and supervision.

The PETREL has been tested, flown and accepted by the Air Service. It is the only commercial aeroplane in production in this country of which this statement is true. Its simple design, its freedom from wires and turnbuckles, and its rigidly braced fuselage combine to cut maintenance costs to the bone and assure a plane whose correct alignment and absolute rigidity are limited only by its long life. And its superior performance gives you more speed or more distance per unit of power expended than you can get with any other three place aeroplane in existence.

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(*Concluded from page 442*)

More popular, of course, will be the speed of the planes themselves; for the reason that the non-technical public can visualize the strain under which the bodies and wings are laboring, little thinking that the motor is undergoing the same strain, at the same time putting from four to six hundred times the strength of a horse (if it is a big healthy horse) behind the air screw that sends the machines along at, let us say, somewhere in the neighborhood of 200 miles an hour. Reduced to feet, the speed which the Pulitzer entries are expected to average is 300 feet a second. Now, it is generally known that the muzzle velocity of a .45-calibre bullet is approximately 1,200 feet a second. The Pulitzer planes therefore will fly about one-fourth as fast as a .45-bullet. They will make four times the average speed of the Twentieth Century, passing four telegraph poles in the time the fastest train in America requires to pass one.

What's the use of all this? A proper question and an important one. The question is easily answered. Speed is the main essential of a pursuit plane. Without speed a pursuit ship would have nothing to pursue, due to the fact that an enemy would soon pull out of sight or fly round it in circles until the machine gun found its mark. And the pursuit plane is the most important factor in aerial warfare. The pursuit plane is used for seeking out and destroying the enemy planes, fast or slow; thereby gaining mastery of the air over its sector, and thus being able to protect the slower observation and bombing machines which can perform their duties without fear of interruption.

Every country on earth is developing pursuit machines. The army and navy air forces have not been idle. Still, while foreign nations repeatedly test out their pursuit planes in scheduled Government trials for big prizes, the Pulitzer Trophy Race, which is a civilian contest primarily, affords the only opportunity for the United States Government to determine the relative values of the many experimental types of planes which have been produced in this country during the last two years. All three of our fighting air forces are participating in the Detroit races—the army, navy and marine corps; and each branch without question will know considerably more about its new fighting equipment after October 14th.

(EDITOR'S NOTE.—Colonel Hartney's description of the machines entered in the Pulitzer race will be published in the October number of AERIAL AGE.)

(*Concluded from page 445*)

170 metric horse-power for 10 meters a second, and roughly 4500 horse-power for 30 meters per second. A tunnel of 5000 or more horse-power might well be recommended.

The first cost of such a tunnel would be of the same order as that of the largest airship shed or astronomical observatory. The cost of operating with very high speeds could be limited by choosing a site near the cheapest source of power. The cost does not seem to be prohibitive either to a nation or to a wealthy patron of science.

The question now raised is as to the value to aeronautics of a full scale wind-tunnel for both absolute and comparative tests. If it be considered very desirable, the representatives of aerodynamics might do well to indicate its advantages. For if the tunnel should appear to be of sufficient importance, the planning and paying for it would perhaps not offer very formidable difficulties. One on a continent would suffice for the present. Various engineers with whom I have discussed the need for a full-scale tunnel are of the opinion that it

(*Concluded on page 478*)

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FOR SALE—3 place DH6-OXX6 motor, first class condition. Spare motor, 3 propellers, wings, struts, wheels, casings and other spares. Best offer takes whole outfit regardless. Address Box 37, Allaben, N. Y.

FOR SALE—Following aeroplanes ready to fly; Thomas-Morse Scout (new) OX5 motor, $600.00. French Spad Scout, 220 H.P. Hispano motor (new) $400.00. Hiendrick Scout OX5 motor, $800.00. Standard J-1 (new) OX6 motor, $1000.00. E. J. Bond, 609 Main St., Houston, Tex.

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FOR SALE—New Liberty motors and parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

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(Concluded from page 474)

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(Concluded from page 453)

Such a city as Monmouth, with its spirit of co-operation and enthusiasm for aviation, is a good place in which to manufacture aeroplanes. Negotiations are right now under way to bring to Monmouth the factory of a ship which is destined to be popular.

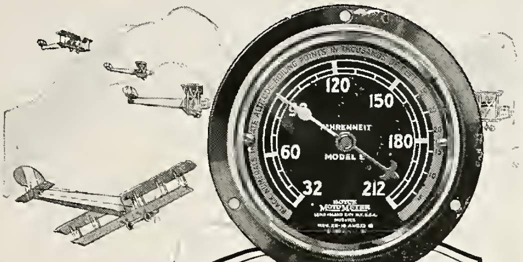
Detroit was just such a city when the automobile was in the same stage as is aviation today, and the man lacks vision who says that aviation is not destined to be as great an industry as is the automobile today.

(Concluded from page 455)

The introduction of twelve-volt ignition has been a distinct step in advance. Even with the poor batteries which were known to have deteriorated in storage, ignition troubles were practically eliminated. The addition of all the weights to the engine has more than been compensated for by the reduction in the weight of the spares to be carried.

As a general result of the winter work, the Commander of the Air Squadrons is convinced that the improvement in material is such that the time is fast approaching when forced landings and delayed starts can no longer be blamed on material but the responsibility therefor can be placed squarely up to the operating personnel.

The alterations and changes in the Liberty engine which have been effected were under the direction of Lieutenant-Commander S. M. Kraus, and Lieutenant B. G. Leighton of the Bureau of Aeronautics and letters commending their work in this connection have been addressed to them by the Chief of the Bureau.



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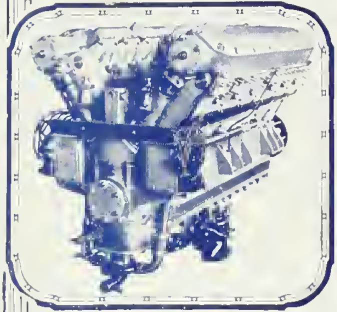

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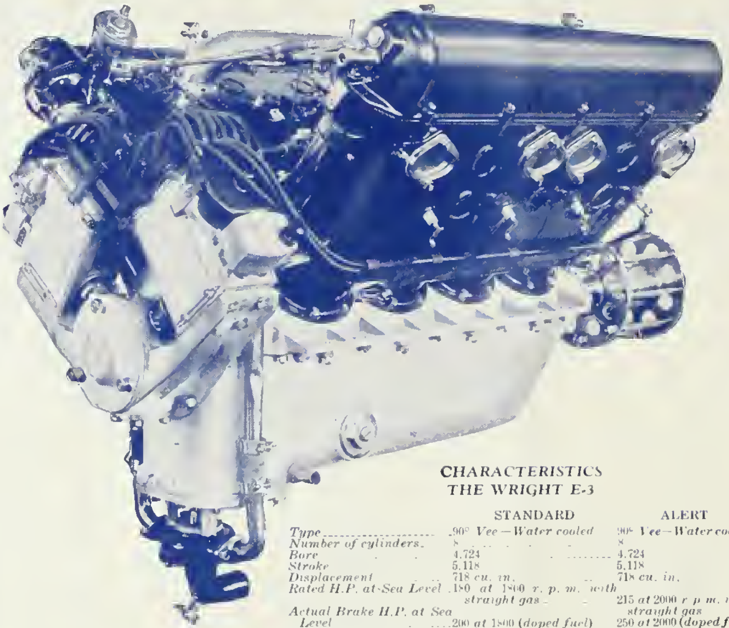

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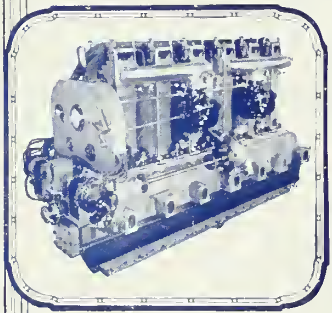

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PUBLISHED MONTHLY BY THE AERIAL AGE COMPANY, Inc., 5942 GRAND CENTRAL TERMINAL, NEW YORK CITY
Subscription: Domestic, $3; Foreign, $5. Entered as second class matter, March 25, 1915, at the Post Office at N. Y. under the Act of March 3rd 1879; also entered on September 22, 1922 at the Post Office at Bethlehem, Pa.

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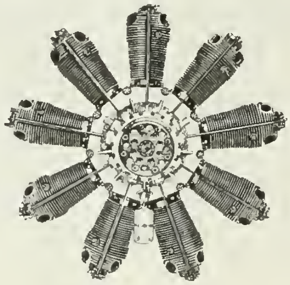

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Cable terminal mag end	.10
Propellers for OX 5 new	25.00
Propellers for foreign motors	25.00
Propeller hubs foreign motors	25.00

PLANE PARTS:

New wings Dee or Canuck with all fittings	60.00
Stabilizers horizontal Dee	22.40
Stabilizers Vertical Dee	9.00
Elevators Dee	10.00
Rudders Dee	16.00
Landing gears with all fittings	30.00
Landing gear struts Dee or Canuck	2.00
Landing gear strut sockets D or C	2.40
26 X 4 Wheels	5.00
Cord casings 26 X 4	3.50
750 X 125 Wheel with tire and tube	23.75
900 X 200 Wheel with tire and tube	58.00
Wind shields for Dee or Canuck	3.50
Tail skid complete assembly for Dee	9.00
Dee Side cowls right or left ea	10.00
Canuck side cowls right or left ea	7.50
Top cowls Dee or Canuck	5.00
Bottom cowls Dee 2 piece both	1.50
Control wires Aileron complete set D	8.00
Control wires Elevator or rudder D	2.00
Struts wing or Center section	2.00
Cabane strut assembly with all wires	5.00

MISCELLANEOUS:

Daylight Fireworks smoke trails	3.50
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Running lights set of 3 red white and green	2.50
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Good grade shock absorber Black per ft.	.05
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Thermometers 16 ft. tube	5.00
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Foreign Shipments: **Quotations on lot shipments to foreign countries solicited. We invite your correspondence. You are cordially invited to visit our modern field and supply depot.**

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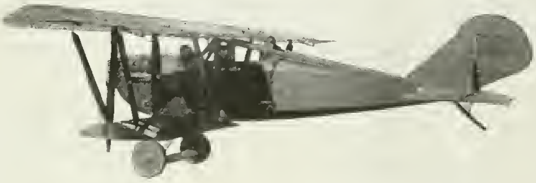

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In the field of commercial aeronautics the PETREL is unique in design and construction, in performance, and in economy of maintenance and operation.

It was designed and developed by Thomas H. Huff, whose experience since 1915 in aircraft production, during the war in aeronautical engineering in an advisory capacity with the U. S. Air Service, and after the war in direct connection with the Naval Aircraft Factory, has qualified him to lead the way in progressive aeroplane design.

The PETREL has been a gradual, certain evolution. During nearly two years of its development careful selections and alterations have been proved by test, and have brought it to its present state of high efficiency.

The PETREL is manufactured by workmen old in the best traditions of aircraft production, and proud of their craft. Every smallest part is selected from the same source, and worked on the same benches, by the same hands, which construct Huff Daland aeroplanes for Army and Navy, under direct government inspection and supervision.

The PETREL has been tested, flown and accepted by the Air Service. It is the only commercial aeroplane in production in this country of which this statement is true. Its simple design, its freedom from wires and turnbuckles, and its rigidly braced fuselage combine to cut maintenance costs to the bone and assure a plane whose correct alignment and absolute rigidity are limited only by its long life. And its superior performance gives you more speed or more distance per unit of power expended than you can get with any other three place aeroplane in existence.

Its specifications and performance with full load are guaranteed:

	OX5 Motor	Hispano Motor
Span	31′ 00″	31′ 00″
Height	9′ 00″	9′ 00″
Length	24′ 00″	24′ 00″
Weight Empty	1125 Pounds	1215 Pounds
Useful Load	735 Pounds	750 Pounds
Radius	300 Miles	350 Miles
Climb in 10″	4500 Feet	8000 Feet
Ceiling	12000 Feet	18000 Feet
Maximum Speed	90 MPH	110 MPH
Minimum Speed	35 MPH	38 MPH

The
PETREL
"Sturdy Simplicity"

HUFF DALAND AERO CORPORATION
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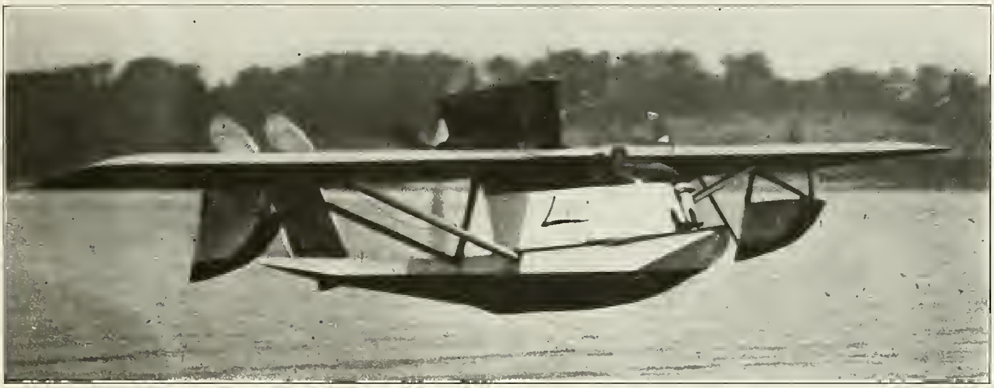

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A very successful aeroplane differing radically from and entirely beyond the class of the old style flying boat.

Those with Aviation experience, who have had the opportunity to fly in this machine have been genuinely surprised at its remarkable qualities of

Seaworthiness
High Speed and Climb
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Several of these Air Yachts, operated this summer, have proved of great utility to their owners.

The price of the new 1923 Model, fully equipped, is $19,500, f. o. b. Factory, New York City.

Sales are only being made directly by the manufacturer, so that all inquiries should be addressed to our Sales Department.

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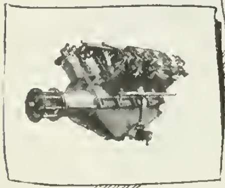
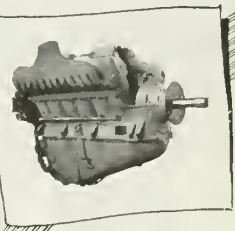
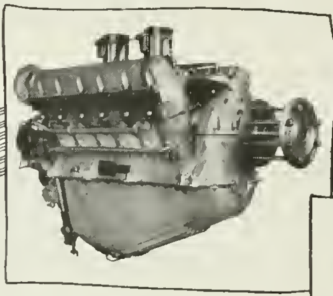


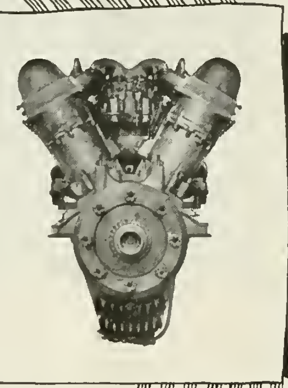
From 1914 until 1917 THE "V" SERIES comprising seven distuct models from 160 to 380 B.H.P. 4.5 to 2.9 lbs. per H.P.



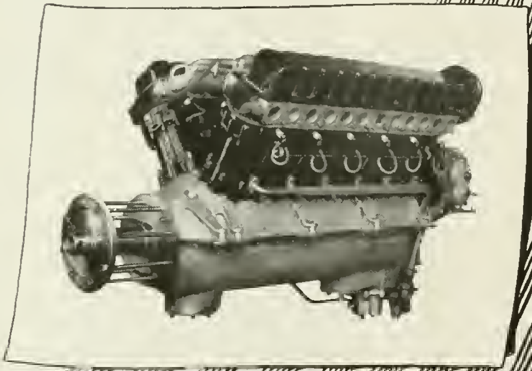
During 1918 The K Twelve of 375 B.H.P. 1.77 lbs. per H.P. World's record for altitude unsupercharged.



During 1920 The C Twelve of 430 B.H.P. 1.64 lbs. per H.P. Second in 1921 Pulitzer Trophy race.



During 1921 The CD Twelve of 390 B.H.P. 1.81 lbs. per H.P. First place in 1921 Pulitzer Trophy Race.



and NOW The D Twelve of 400 B.H.P. 1.68 lbs. per H.P. The latest and best pursuit engine. The result of many years of engineering endeavor to produce the ideal combat power plant.

CONTRIBUTIONS TO AERONAUTICS

THERE has been no time since its earliest inception when Curtiss has not been a name to conjure with in aeronautics.

The art of flying and the efficiency of flying machines have only progressed as fast as Curtiss has progressed.

The Curtiss contribution from year to year will continue to be expressed in this great organization and the products of its ability.

Curtiss

CURTISS AEROPLANE
AND MOTOR CORPORATION
Garden City, Long Island, N.Y., U.S.A.

The Detroit Races

ENTRIES ASSURE GREATEST AERONAUTIC EVENT ON RECORD

PRESIDENT Harding has expressed his appreciation of the national importance and significance of the Second National Aero Congress to be held in Detroit and the National Airplane Races to be held at Selfridge Field, Mt. Clemens, October 12, 13, & 14. Howard E. Coffin, Chairman of the National Committee on Organization received the President's letter. It reads:

"I have many times given expression to my interest in the development of aviation. I fully realize the influence which this newest and speediest means of transportation and travel is destined to exert upon civilization.

"Aviation's vitally important part in the general scheme of our own national defense is already well recognized. A strong and healthy commercial aviation development is a prerequisite to all adequate plans involving our national security and welfare.

"Therefore, it is with the greatest satisfaction that I extend to the Detroit Aviation Society and, through your committee, to the National Aeronautic Association my sincere appreciation of the objects you are seeking and my best wishes for the complete success both of the October contests and of the national convention to be held coincident therewith."

Sincerely yours,
(Signed) Warren G. Harding

Fifty-five entries have so far been confirmed in the principal contests for the national races. The large number of entries and the unprecedented preparations being made to accommodate the thousands at Selfridge Field will make the National Airplane Races the greatest and at the same time the most thrilling event in the annals of sport, officials assert.

Delegates from more than sixty cities have made reservations for the air convention.

The Curtiss Marine Flying Trophy Race will be held on October 7th. More than a dozen seaplanes and flying boats have been entered so far in this over-water classic which is the premier event in marine aviation.

On October 12, 13 & 14 a series of races for overland planes will be held, chiefly among them being the PULITZER TROPHY RACE, the speed classic of the world. To date there are twenty-four entries for the Pulitzer contest. It is believed these entries will break the world's record made in last year's Pulitzer race.

All the Executive and Administrative branches of the Government have endorsed these events, the Army, Navy and Marine Corps having entered their latest and fastest planes. Other races will be held for large multi-motored planes, light commercial machines and 2-passenger observation planes.

In all, $10,000 in money prizes and $30,000 worth of gold and silver trophies will be awarded.

On the dates of the races for overland planes the Second National Aero Congress will convene. Delegates are being appointed from more than 60 cities in the United States. They will come to Detroit principally to organize a permanent national aeronautic association.

Aviation is the new great arm of the national defense and all Americans are vitally interested in this powerful weapon. Then, too, the science of flight is the new medium of travel and transport.

The national aeronautic association will represent all Americans, represent their thought and echo their voice in the halls of the municipal, state and national legislatures.

The delegates to the Second National Aero Congress will draft the constitution and by-laws of this representative organization. Representatives of the National Air Association and the Aero Club of America are co-operating with the advance committee of 500 prominent men in the initial work incident to the organization.

The principal national business to come before the delegates will be the drafting of a program to hasten the adoption of federal air laws and the formation by act of Congress of a bureau of civil aeronautics in the Department of Commerce.

Need for Air Laws

For three or four years Congress has had many measures under consideration, legislation which would place civilian flying under Federal jurisdiction.

The U. S. Army Air Service, the Naval Bureau of Aeronautics and the U. S. Air Mail Service are functioning with an efficiency approximating 100 per cent. They are credited with far-reaching developments in military and naval aerial operations; and are the equal, in many respects superior, to similar air forces abroad. But the military and naval air forces are not handicapped by lack of jurisdiction. Each has its highly trained executive and specialized personnel. That fact accounts for the prestige of American service aviaton to-day.

With civilian aviation it is different. If the public has lost sight of the peaceful attributes of aircraft, it is due for a change of vision. A means of transport which carried more than 150,000 pounds of parcel freight and approximately 250,000 passengers last year must eventually attract sufficient public attention to penetrate the halls of Congress.

Civilian operators, designers and financial supporters of aviation urge the Government to do something to create Federal supervision over civilian flying. For several months this nation-wide demand has been expressed in the Wadsworth bill.

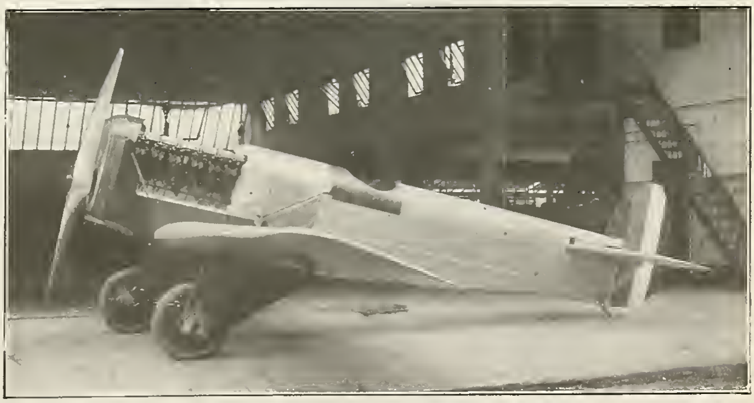
The bill was endorsed by everybody when it was first introduced in the Senate and passed last February. All who had considered the problem approved it; Mayors, State legislatures, flying clubs, State aviation committees and the manufacturers and operators of aircraft. In fact, the aircraft industry is the first infant industry to go on record as desiring to have itself regulated.

Everything Regulated Except Aviation

Operators and constructors have been twixt the devil and the deep blue sea, in a manner of speaking. They have not been controlled by national authority in any form; and after all, control is synonymous with protection. To-day anybody can fly in any sort of an old crate without a license. In a country where one requires a license to hunt, marry, keep a dog, build a house or dig a tunnel, one can do anything he wants to in the air without first qualifying for his job or making his flying machine airworthy.

More than ninety per cent of the aircraft accidents are caused by irresponsible persons operating unairworthy machines. It has led to many serious accidents and has kept capital out of commercial aviation, the sort of aviation that is needed if we are to develop aerial transport facilities to a point where they shall provide an adequate reserve which our excellent Army and Navy air forces may draw upon in an emergency. The Wadsworth bill has been in the House Committee on Interstate and Foreign Commerce since last February. Why it has not been brought out and acted upon, nobody knows.

Meanwhile the aviator is a potential outlaw. For if he damages another's property, falls on him or with him, tears up the grass on a courthouse lawn, in fact, if anything happens that the party of the first part, to wit, the plaintiff, believes should not have happened, the pilot can be prosecuted under the common law, without aerial law, license or legal prerogatives to protect him. Airmen desire wise and strict laws to protect the public, their foolish and erring brethren and themselves. They know their insurance rates will then be reduced.



The Loening Racer, designed by Grover C. Loening.

U.S.

BRASS

919,569 Pounds for Sale by Sealed Bid
Closing at 12 o'clock Noon May 25th 1922
At Frankford Arsenal, Phila, Pa.

Terms of Sale:

Bids will be received for the entire lot only, and must be accompanied by a certified check or U. S. bonds to the amount of 10% of the bid. The material is loose and is to be sold f. o. b. cars at Westville, N. J.

No guarantee is given as to quality, quantity, analysis, weight or condition and no refund or adjustment will be allowed after award is made. Inspection of the material is invited. Awards will be made within 72 hours after opening of the bids. The Government, however, reserves the right to reject any or all bids

SEALED bids for the purchase of approximately 919,569 pounds of Brass Extrusion and Regular Caps for caliber .30 cartridge cases, located at the Woodbury Ordnance Reserve Depot, Westville, N. J., will be received by the Philadelphia District Ordnance Salvage Board not later than 12 noon Thursday, May 25, 1922.

Proposal blanks must be signed in ink by bidders and should be inclosed in a sealed envelope addressed to the undersigned and marked "Bid for the purchase of Brass Extrusion and Regular Caps for Cartridge Cases."

ular proposal blanks containing complete in- as to terms and conditions will be fur- application to

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Oct. 10—Q. M. SUPPLIES–
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Q. M. S. O., 1819 W
Pershing Road, Chicago
Ill.

Oct. 10—MEDICAL SUPPLIES–
New York City, Auc
tion. For catalo
write Surplus Propert
Sect., Office, Surgeo
General, Washington
D. C.

Oct. 11—AIR SERVICE SUP
PLIES—Carlstron
Field, Fla., Auction
For catalog, write com
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strom Field, Fla.

Oct. 17—Q. M. SUPPLIES–
Camp Dix, N. J., Auc
tion. For catalog write
Q. M. S. O., 1st. Ave
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N. Y.

Oct. 19—POWER HOUS
EQUIPMENT—Rock
Island, Ill., Sealed Bids
For catalog, write C
O., Rock Island Arse
nal, Rock Island, Ill

Oct. 24—AIR SERVICE EQUIP
MENT—Montgomery
Ala., Auction. For cat
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Reserve Depot, Mont
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Oct. 24—FLOATING EQUIP
MENT—Port Newark
N. J., Auction. Fo
catalog write Q. M. S
O., 1st. Ave. & 59th
St., Brooklyn, N. Y.

Oct. 27—MEDICAL SUPPLIES–
Washington, D. C., Auc
tion. For catalog writ
Surplus Property sect.
Office, Surgeon Gen
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Oct. 30—AIR SERVICE EQUIP
MENT—Richmond
Va., Auction. For cata
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NOV. 10—Q. M. SUPPLIES–
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Nov. 14—Q. M. SUPPLIES—Camp Lewis, Wash., Auction. For catalog write Q. M. S. O., Ft. Mason, San Francisco, Calif.

Nov. 14—AIR SERVICE EQUIPMENT—Long Island, N. Y., Auction. For catalog write C. O., Air Service Depot, Long N. Y.

Nov. 15—Q. M. SUPPLIES—Brooklyn, N. Y., Auction. For catalog Write Q. M. S. O., 1st. Ave. & 59th. St., Brooklyn, N. Y.

Nov. 16—MEDICAL SUPPLIES—Philadelphia, Pa., Auction. For catalog write Surplus Property Sect. Office, Surgeon General, Washington, D. C

Nov. 21—Q. M. SUPPLIES—Camp Knox, Ky., Auction. For catalog write Q. M. S. O., 1819 W. Pershing Road, Chicago Ill.

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Nov. 28—Q. M. SUPPLIES—New Orleans, La., Auction. For catalog write C. O., Q. M. Surplus Property Depot, Atlanta, Ga.

D-c. 5—Q. M. SUPPLIES—San Antonio, Tex., Auction. For catalog write Q. M. S. O., Ft. Sam Houston, San Antonio, Texas.

Dec. 12—Q. M. SUPPLIES— Columbus, Ohio, Auction. For catalog write, Q. M. S. O., 1819 W. Pershing Road, Chicago, Ill.

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Men Have Slaved Years To Make *What One of these ads will save you*

YOUR favorite paper or business publication will tell you more about how to pay dividends than all the stock selling literature in the world.

Just turn to the War Department announcements of Surplus Property Sales.

You will soon find something you need. And when you do, be sure to send at once for the catalog— for it will point out an opportunity such as has never occurred in the past and is unlikely ever to occur in the future.

These sales cover every conceivable product. Manufacturers can secure machinery, supplies and raw materials. Retailers can secure merchandise of every description. And everything you buy is ready for immediate shipment.

Watch the sales! It's an easy matter to follow the War Department announcements—but not so easy to duplicate the savings they offer. If you want further information, write to J. L. Frink, Chief, Sales Promotion Section, Office, Director of Sales, Room 2515 Munitions Bldg., Washington, D. C.

RTMENT

Rates are now prohibitive.

The aviator points to the motoris who at first fought highway laws, but who now earnestly supports them

All the great Powers have national air laws except the United States. The Canadian Air Board prohibits flying where the pilot has not been licensed or his plane registered. Pilots are examined and their machines inspected periodically. American pilots are automatically barred from flying over Canadian territory because they are not licensed in this country. The Canadian Air Board, however, has courteously extended permission to our Army and Navy aviators on the grounds that their record proves rigid training and general efficiency.

Races Over Canadian Waters

Two of the courses in the National Airplane Races at Detroit extend over Lake St. Clair, part of which is Canadian territory. Due to our lack of national air laws and the Canadian proscription against our hit and miss civilian flying, civilian entries in the races would be barred.

The Canadian Air Board has been requested to lift the ban for the purpose of the races. Meanwhile strong representations will be made at the Aero Congress asking the legislative branch of the American Government to remedy the situation by the immediate passage of the Wadsworth bill.

The Aero Congress alone would be important, from the national viewpoint, but the National Airplane Races will attract thousands of visitors to Detroit. Official observers are being sent by foreign Governments.

They know that the Army, Navy and Marine Corps air forces, as well as many civilian constructors, have developed nearly forty different types of airplanes in the last two years. The races afford the first opportunity to test these machines under conditions which will disclose their qualities of speed, endurance and all-around efficiency. It is believed that several records will be made as more than a dozen machines are being built for an average speed of 200 miles an hou. over a closed course of 160 miles. Several planes are being secretly built, their general specifications remaining a mystery until the rules of the race force the constructors to describe them in official entry blanks.

The Pulitzer Trophy Race, while a contest for the fastest land machines, will be held over a triangular course of 40 miles to a lap (4 laps, or 160 miles) the entire course being over the waters of Lake St. Clair, with the exception of the starting and finishing point at Selfridge Field, Mt. Clemens, Mich., where a monster grandstand is being built to accommodate the thousands who usually attend national sporting events. The National Airplane Races this year will be as important as the national motor car races in early days because they will bring out the qualities and defects in the various flying machines. Which is another reason why foreign Governments are watching this year's event so closely.

Notes on Navy's Entries for Detroit Races

Curtiss Marine Trophy Race

Type VE-7H is the standard Vought two-seater advanced training plane now used by the Navy as an observation plane and fitted with a pontoon. This airplane was designed and built by Mr. Chance Vought in 1918 and is supplied as standard equipment to the Atlantic and Pacific Fleet Air Squadrons as a single-seater land plane for combat training, as a two-seater land plane for general observation duty, and as a two-seater seaplane as an observation plane to be carried aboard ship. Vought planes of this type are now on board the MARYLAND and have been successfuly launched from the MARYLAND'S catapult. The Wright E-3, 8 cyl. engine is a modification of the standard 180 H. P. E-2 engine made by the same firm, the modifications consisting essentially in high compression pistons, high lift cams and other alterations which permit the engine to develop between 220 and 240 H. P. at 2,000 revolutions. The high compression E-3 engine is designed for blended fuel.

The HA is a Curtis designed and built seaplane brought out in 1918 as an answer to high performance German seaplanes which were interfering with the bombing operations conducted against the German submarine bases on the Belgian coast. The problem was to develop a fast two-seater seaplane using a single Liberty engine. Due to change in conditions the HA type was never put into production, and the sample plane tested in 1918 has been reconditioned and entered in the Curtiss Marine Trophy Race, sion Liberty is a standard Liberty engine Liberty engine. A special high compres- but fitted with a special high compression with high compression pistons and new valves and should develop over 420 H.P. on blended fuel. The machine was designed by Mr. W. L. Gilmor of the Curtiss Aeroplane & Motor Corporation in cooperation with Major B. L. Smith. U. S. Marine Corps.

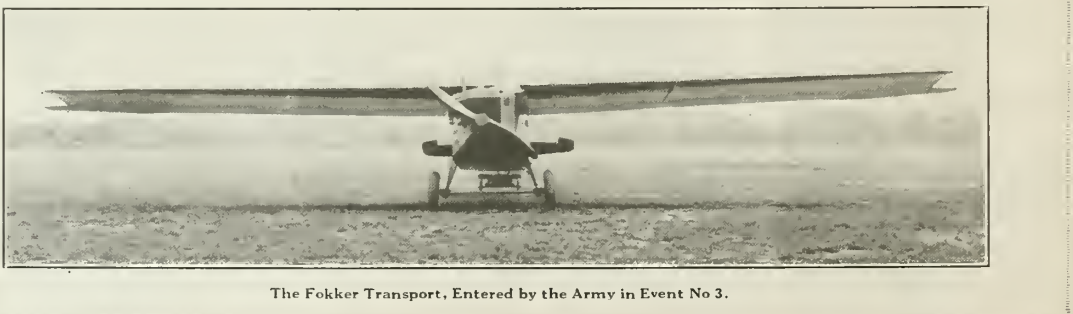
The H-16 is a standard twin Liberty engined flying boat used during the War both by the American and British Navies for submarine patrol and convoy duty. The plane was designed by Mr. G. H. Curtiss and built by the Curtiss Aeroplane & Motor Corporation in 1916. The Navy Department has a large number of these planes on hand and the one entered in the race is standard in all respects except that the Liberty engines have been provided with special high compression pistons. The H-16 will be flown from the Naval Aircraft Factory to Detroit for the race, following the Hudson River, the Lakes of New York State to the Great Lakes.

The D-4 is a tractor biplane designed by Mr. Edson Gallaudet and built by the Gallaudet Aircraft Corporation in 1918. It was built for the Navy as a high speed two-seater seaplane making use of the Gallaudet gear drive. It is believed to be the only gear driven plane in the country and is of considerable technical interest for this reason. It is fitted with a single Liberty engine mounted in the fuselage, which drives by means of a ring gear a propeller which is situated immediately behind the wings. The fuselage or tail structure of the airplane extends through the center of the ring gear carrying the propeller.

Model 18-T tractor triplane was designed by Mr. C. B. Kirkham and built in 1918 by the Curtiss Aeroplane and Motor Corporation as a two-seater combat plane of maximum performance. Had the War continued it is likely that this type would have been put into production for use on the Western Front. As it was, the sample plane made on trials a high speed of 162 miles an hour which was then a world's record for any type of airplane and is still believed a world's record for a two-seater fighting machine. For the purpose of the Curtiss Marine Trophy Race two of these airplanes which were in store have been reconditioned and fitted with pontoons to convert them to seaplanes. They are fitted with the Curtiss CC-12, 400 H.P., a light 12-cylinder engine especially designed for this airplane. These triplanes are believed to be the only triplanes in the country and are of considerable technical interest on this account.

The UO-1 is a new type of Vought observation seaplane, being developed by the Chance Vought Corporation for the Navy Department as a replacement for the standard VE-7 Vought now used on ships for catapult launching. The plane is equipped with the new Aeromarine 250 H.P. engine which presents a new feature in aeronau- light 12-cylinder engine especially designed der heads.

Types TS-1 and 2, and TR-1 and 3 are variations of the Navy shipboard combat plane type TS as designed by the Design Section of the Bureau of Aeronautics and



The Fokker Transport, Entered by the Army in Event No 3.

built at the Naval Aircraft Factory. The TS planes were designed to give the smallest and most compact plane with the maximum facilities for take-down and erection aboard ship. All wires and turnbuckles in the wing bracing are eliminated to facilitate rapid erection. The fuel tank is carried in the lower wing and is made detachable so that in case of fire, due to an incendiary bullet, the pilot can pull a release which will drop the tank and its inflammable contents clear of the machine. Another unique feature is the provision of interchangeable landing gears so that the TS planes may be used with land wheels as an ordinary land plane, or with twin pontoons as a seaplane depending upon the service required. The TS-1 is equipped with a new Lawrence air-cooled radial engine rated at 220 H.P. This is the last word in air-cooled engine development and the Race is considered an excellent place to give this engine a severe tryout. The engine has been developed for the Navy especially for the problem of shipboard airplanes where minimum weight and the greatest simplicity are prerequisites. The TS-2 is the same plane equipped with the Aeromarine 240 H.P. engine. The TR-1 is the same TS plane provided with a Lawrence air-cooled engine, but given special racing wings, and the TR-3 is the same as the TR-1 except that Wright E-2, 220 H.P. engine has been substituted. These four planes constitute then a full-scale experiment of the greatest technical interest to the Navy, using three different engines and two different designs of wing. The occasion of the Curtiss Marine Trophy Race has been used to try out these design modifications under competitive conditions. The planes include a maximum of new and advanced features both in engineering and aerodynamics, and it is believed that the race between these four planes is secondary in interest only to the race for the Curtiss Marine Trophy for which they will compete.

Pulitzer Race

The CR biplanes are well known since one of them piloted by Mr. Bert Acosta won the race for the Pulitzer Trophy at Omaha last year making a speed of 176-7 miles per hour, the World's Record for a closed course. The same plane tried over a straightaway has made 197.8 miles per hour which is an American speed record if not a World's Record for straight flight.

The CR type was designed by the Curtiss Aeroplane & Motor Corporation in cooperation with the Navy Department and built by that corporation in an effort to produce an airplane with the maximum aerodynamic refinement. The CR planes are equipped with a Curtiss 12-cylinder, 400 H.P. engine which is still a relatively new engine developed by the Curtiss Company for the Navy Department, but not yet in general service use. The information obtained by testing this engine in races is being applied in the form of modifications to the sample engine, before such engines are adopted for general service. The CR machine, as the present title holder, is of course the favorite based on past performance. It is the first airplane in this country to have attained speeds above 190 miles and it is due largely to the special wing construction adopted that no difficulties were experienced. Abroad in connection with racing there has been a succession of wing failures in the air largely due to fabric tearing loose under the action of terrific pressures generated at these speeds. However, the CR plane has its wing covered with plywood to which the fabric covering is glued and ironed in place so that there is no possibility of it working loose.

The BR type airplanes are designed by Messrs. Booth and Thurston of the Aerial Engineering Corporation, Hammondsport, N.Y., who a year ago were employees of the Curtiss Aeroplane and Motor Corporation and worked on the design of the CR plane. Therefore, it may be concluded that the BR will incorporate a good deal of the experience of the CR type. The BR represents an attempt to take another step in the matter of aerodynamics refinement suppressing completely the structural bracing required by wings of a biplane by the use of an unbraced monoplane wing. In addition, there is a retracting land gear by which the entire landing gear is retracted into the body of the fuselage once the plane is in the air so that in flight only the fuselage and wings present resistance to the air. These are radical innovations in the art of airplane design and if successful should materially increase the speed that airplanes are capable of making today. A further innovation of a frankly experimental character has been tried on one of the BR planes and this is the complete suppression of the radiator which all water-cooled engines have to have carried for them. This is done by covering the entire wing with a thin sheet of copper under which the water circulates so that the wing itself becomes one large radiator performing the double function of cooling the engine and supporting the weight of the plane. If it be proved possible by the gruelling conditions of a race to cool the engine developing its ultimate maximum of power a very important advance in aeronautical engineering will have been made. In general, the BR air planes represent in their design and construction not only the last word in refinement, but three radical innovations in design which, if successful, will have a profound influence on the future design of high performance military and navel airplanes. The BR planes are fitted with the Wright H-3 special high compression engine developing 400 H.P.

The MB-7 is a tiny monoplane designed and built for the Navy by the Thomas-Morse Company for the Pulitzer Race of last year and, although this little airplane did not finish the race due unfortunately to a forced landing in which Col. Hartney, who was flying the plane for the contractor, was injured, it nevertheless gave a very good account of itself and it is proposed to enter the machine again in this year's race. The MB-7 is equipped with the special 400 H.P. Wright H-3 engine that is also used in the BR plane. The MB-7 does not present any radical features, but is a conventional monoplane of the very minimum size to carry this large engine and speed is obtained by a low power-weight ratio.

No. 1.

Many Entries For Event

Curtiss Marine Flying Trophy

VE-7H Tractor Biplane VA Class

Span—upper and lower—34′ 1⅜″
Length—30′ 1″
Height—10′ 2″
Chord—4′ 7½″
Gap—4′ 8″
Angle of Incidence—Upper 1° 45′, Lower 2° 15′.
Dihedral—1° 15′
Wing Area—284.5sq. ft.
Aerofoil Sec. R.A.F.—15
Gross Weight—2175
Maximum Speed—120

Engine—Wright E-3. 220 H.P.

Designed—by Mr. Chance Vought.

Built by Chance Vought Corporation.

Pilot: H. A. Elliot, Lieutenant, U.S.N.

TS-2 Tractor Biplane VF Class

Span—upper and lower—25′ 0″
Length—24′ 7″
Height—9′ 6¾″
Chord—4′ 9″
Gap—5′ 6″
Angle of Incidence—0
Dihedral—3° (lower wing only)
Wing Area—225 sq. ft.
Aerofoil Section—USA—27
Gross Weight—2085
Maximum speed—130

Engine—Aeromarine U—8—D, 240 H.P.

Designed by Design Section, Bureau of Aeronautics, Navy. Department. (Comdr. Hunsaker).

Built by Naval Aircraft Factory.
Pilot: H. J. Brow, Lieutenant, U.S.N.

TS-1 Tractor Biplane VA Class

Span—upper and lower—25′ 0″
Length—24′ 7″
Height—9′ 6¾″
Chord—4′ 9″
Gap—5″ 6′
Angle of Incidence—0
Dihedral—3° (Lower wing only)
Wing Area—225 Sq. ft.
Aerofoil Section—USA—27
Gross Weight—2025
Maximum Speed—125

Engine Lawrence J—1, 220 H.P.

Designed by Design Section, Bureau of Aeronautics, Navy Dept., (Comdr. Hunsaker)

Built by Curtiss Aeroplane & Motor Corpn.

Pilot: S. W. Callaway, Lieut. (jg) U.S.N.

TR-3 Tractor Biplane VF Class

Span—upper and lower—25′ 0″
Length—24′ 7″
Height—9′ 6¾″
Chord—4′ 9″
Gap—5′ 6″
Angle of Incidence—0
Dihedral—3° (lower wing only)
Wing Area—225 sq. ft
Aerofoil Section—Mod. RAF—15
Gross Weight—1980
Maximum speed—130

Engine—Wright E—3, 220 H.P.

Designed by Design Section, Bureau of Aeronautics, Navy Dept. (Comdr. Hunsaker).

Built by Naval Aircraft Factory.

Pilot: D. Rittenhouse, Lieutenant, U.S.N.

TR-1 Tractor Biplane VF Class

Span—upper and lower—25′ 0″
Length—24′ 7″
Height—9′ 6¾″
Chord—4′ 9″
Gap—5′ 6″

Angle of Incidence—0
Dihedral—3° (Lower wing only)
Wing Area—225 Sq. ft.
Aerofoil Section—Mod. RAF—15
Gross Weight—1790
Maximum Speed—130
Engine Lawrence J—1, 220 H.P.
Designed by Design Section, Bureau of Aeronautics, Navy Dept., (Comdr. Hunsaker)
Built by Naval Aircraft Factory.
Pilot: A. W. Gorton, **Lieutenant, U.S.N.**

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HA Tractor Biplane VF Class
Span—upper and lower—42′ 0″
Length—30′ 9″
Height—11′ 5″
Chord—6′ 2″
Gap—6′
Angle of Incidence—0
Dihedral—0
Wing Area—490 sq. ft.
Aerofoil Section—Sloane
Gross Weight—3906
Maximum speed—135
Engine—Liberty Special H.C., 420 H.P.
Designed by Curtiss Aeroplane & Motor Corp. (Mr. W. L. Gilmor)
Built by Curtiss Aeroplane & Motor Corporation.
Pilot: A. J. Williams, Ens., U.S.N.

H-16 Tractor Biplane VP Class
Span—Upper 95′ 1″, Lower 68′ 11″
Length—46′ 2″
Height—17′ 9″
Chord—7′ 1″
Gap—8′ 1″
Angle of Incidence—4°
Dihedral—1°
Wing Area—1164 sq. ft.
Aerofoil Section R-14—6
Gross Weight—10000
Maximum Speed—100
Engine—Liberty Special H. C., 420 H. P. engine
Designed by Curtiss Aeroplane & Motor Corpn. (Mr. G. H. Curtiss)
Built by Curtiss Aeroplane & Motor Corp.
Pilot: R. Irvine, Lientenant, U. S. N.

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D-4 Tractor Biplane VF Class
Span—Upper, 46′ 5″, Lower 45′
Length—33′ 6″
Height—11′ 8″
Chord—7′
Gap—7′
Angle of Incidence—2° 10′
Dihedral—0
Wing Area—620 sq. ft
Aerofoil Section RAF—15
Gross Weight—5440
Maximum speed—135
Landing speed—55
Trial Report—No. 5, dated Feb. 1919.
Engine—Liberty Special H.C., 420 H.P.
Designed by Gallaudet Aircraft Corp. (Mr. Edson Gallaudet)
Built by Gallaudet Aircraft Corp. (about first of 1918)
Pilot: W. K. Patterson, Lieutenant, U.S.N.

18-T Tractor Triplane VF Class
Span—Upper, Lower and Middle—40′ 7½″
Length—28′ 3⅞″
Height—12′
Chord—3′ 6″
Gap—Upper 3′ 6″, Lower 2′ 11″
Angle of Incidence—2½°
Dihedral—0
Wing Area—400 sq. ft
Aerofoil Section—Sloane
Gross Weight—3972
Maximum Speed—140
Engine—Curtiss C-D-12, 400 H.P.
Designed by Curtiss Aeroplane & Motor Corpn. (Mr. C.B. Kirkman)
Maximum Speed—120
Wing Area—284.4 sq. ft

Lt. O. G. Kelly, who will pilot the Fokker Transport

Aerofoil Section—RAF 15
Gross Weight—2175
Built by Curtiss Aeroplane & Motor Corp.
Pilot: T. B. Lee, Lieutenant, (jg) U.S.N.

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18-T Tractor Triplane VF Class
Span—Upper, Lower and Middle—40′ 7½″
Length—28′ 3⅞″
Height—12′
Chord—3′ 6″
Gap—Upper 3′ 6″,
Lower 2′ 11″
Angle of Incidence—2½°
Dihedral—0
Wing Area—400 sq. ft.
Aerofoil Section—Sloane
Gross Weight—3972
Maximum speed—140
Engine—Curtiss C-D-12, 400 H.P.
Designed by Curtiss Aeroplane & Motor Corp. (Mr. C.B. Kirkman)
Built by Curtiss Aeroplane & Motor Corporation.
Pilot: L. H. Sanderson, 1st Lieut. U.S.M.C.

UO-1 Tractor Biplane VO Class
Span—Upper 34′ 1⅜″, Lower 34′ 1⅜″
Length—29′ 3″
Height—10′
Chord—6′
Gap—4′ 8″
Angle of Incidence—0
Dihedral—0
Wing Area—308 sq. ft.
Aerofoil Section—Albatros.
Gross Weight—2608
Maximum Speed—130
Engine—Aeromarine U—873, 250 H.P.
Designed—by Chance Vought Corporation. (Mr. Chance Vought.)
Built by Chance Vought Corp.
Pilot: M. A. Mitscher, Lieut. Comdr. U.S.N

Navy Entries For Event No. 4

VE-7-H Tractor Biplane VA Class
Span—Upper and Lower—34′ 1⅜″
Length—30′ 1″
Height—10′ 2″
Chord—4′ 7½″
Gap—4′ 8″
Angle of Incidence—Upper 1° 45′, Lower 2° 15′
Dihedral—1° 15′
Wing Area—284.4 sq. ft.
Aerofoil Section—RAF—15
Gross Weight—2175
Maximum Speed—120
Engine—Wright E-3, 220 H.P.
Designed—by Chance Vought Corporation. (Mr. Chance Vought.)
Built by Chance Vought Corp.
Pilot: H. A. Elliot, Lieutenant, U.S.N.

Tractor Biplane

Span—Upper and Lower—22′ 8″
Length—20′ 9″
Height—8′ 0″
Chord—4′ 0″
Gap—4′ 0″
Angle of Incidence—0
Dihedral—2° (Lower wing only)
Wing Area—168
Aerofoil Section—Sloane
Gross Weight—2095
Maximum Speed—186
Stalling Speed—65
Trial Report,—No. 115, dated March, 1922.
Engine—Curtiss D—12, 400 H.P.
Designed by Curtiss Aeroplane & Motor Corpn. (Messrs. Gilmor, Booth & Thurston).
Built by Curtiss Aeroplane & Motor Corp. Sept. 1921.
Pilot: F. Fechteler, Lieutenant, U.S.N or H. J. Brow, Lieutenant, U.S.N.

Tractor Monoplane

Span-28′ 1″
Length-21′ 1¼″
Height-6′ 4 1/2″
Chord-2′ at tips to 6′ at fuselage
Gap-O
Angle of Incidence-O
Dihedral-3 1/1°
Wing Area-104
Aerofoil Section-Gottengen No. 387
Gross Weight-2020
Maximum speed-190
Stalling Speed-70
Engine-Wright H-3, 400 H. P.
Designed by Aerial Engineering Corp (Messrs. Booth & Thurston)
Built by Aerial Engineering Corp.
Pilot: S. W. Calloway, Lieut. (jg) U. S. N

Tractor Monoplane

Span-28′ 1″
Length-21′ 1 1/4″
Height-6′ 4 1/2″
Chord -2′ at tips to 6′ at fuselage
Gap-O
Angle of Incidence-
Dihedral-3 1/2°
Wing Area-104
Aerofoil Section-Gottengen No. 387
Gross Weight-2020
Maximum Speed-190
Stalling Speed-70
Engine-Wright H-3, 400 H. P.
Designed-by Aerial Engineering Corp (Messrs. Booth & Thurston)
Built by Aerial Engineering Corp.
Pilot: David Rittenhouse, Lieut. U. S. N.

Tractor Biplane

Span-Upper and Lower-22′ 8″
Length-20′ 9″
Height-8′ 0″
Chord-4′ 0″
Gap-4′ 0″
Angle of Incidence-0
Dihedral-2° (Lower wing only)
Wing Area-168
Aerofoil Section-Sloane
Gross Weight-2095
Maximum Speed-186
Stalling Speed-65
Trial Report, -No. 115, dated March, 1922.
Engine-Curtiss CD-12, 400 H. P.
Designed by Curtiss Aeroplane & Motor

The National Airplane Races this year will be as important as the National Motor Car Races in the early days, because they will bring out the qualities and defects in the various flying machines. The main event will be the Pulitzer Trophy Race, a contest for the fastest land Machines, which will be held over a triangular course totalling 160 miles (4 laps of 40 miles each), the entire course being over the waters of Lake St. Clair, with the exception of the landing and finishing point at Selfridge Field, Mt. Clemens.

The Army pilots and alternates, and the machines they are to fly, are as follows:

Army Entries in Pulitzer Race

Events	Type	Pilot	Alternate
Event No. 2.	L. W. F. "Owl"	Lt. Ernest E. Harmon	Lt. Leslie P. Arnold
Large capacity multi-motored airplanes	Martin Bomber	Capt. W. R. Lawson	Lt. Raymond E. Davis
	" "	Lt. Chas. M. Cummings	Lt. Levi L. Beery
	" "	Lt. Gerald E. Ballard	Lt. Chas. B. Austin
	" "	Lt. Phillip Melville	Major John H. Pirie
	Martin Transport	Lt. Erik H. Nelson	
Event No. 3.	Fokker Transport	Lt. O. G. Kelly	Lt. R. S. Worthington
Light Commercial airplanes	DH4B	Lt. Harold R. Harris	Major Fred H. Coleman
Event No. 4.	DH4B	Lt. Benj. R. Morton	Lt. Frank M. Paul
Observation type, 2-passenger airplanes	"	Lt. James D. Givens	Capt. Ernest Clark
	"	Lt. Warren R. Carter	Lt. Edwin B. Robzien
	"	Maj. Follett Bradley	Major F. L. Martin
	LePere	Lt. T. K. Koenig	Lt. John W. Monahan
	"	Lt. Wm. L. Boyd	Lt. Geo. W. Goddard
	XBLA	Lt. Dale V. Gaffney	Lt. Delmar H. Dunton
	"	Capt. Lloyd L. Harvey	Lt. Howard K. Ramey
Event No. 4.	VCP-1-600HP	Lt. C. S. Moseley	Lt. L. Wade
High Speed Pulitzer	Curtiss CD12 375 hp	Lt. R. L. Maughan	Lt. Bushrod Hoppin
	" " " "	Lt. L. J. Matland	Lt. C. V. Haynes
	Loening, 600 h. p.	Lt. E. C. Whitehead	Lt. G. P. Tourtellot
	" " "	Lt. L. D. Schulze	Lt. J. T. Hutchison
	Thos. Morse, 600 hp	Capt. F. O. D. Hunter	Lt. C. E. Crumrine
	" " " "	Lt. C. L. Bissell	Lt. T. K. Matthews
	Sperry, 350 h. p.	Lt. E. H. Barksdale	Lt. G. C. McDonald
	" " "	Capt. St. C. Streett	Lt. V. S. Miner
	" " "	Lt. F. B. Johnson	Lt. K. N. Walker
	M. B. 3	Capt. Burt E. Skeel	Capt. Albert M. Guidera
	"	Lt. Benj. K. McBride	Lt. Walter H. Reid
	"	Lt. Donald F. Stace	Capt. Vincent B. Dixon
	"	Capt. H. M. Elmendorf	Lt. Roy P. Mosher
"	"	Capt. Oliver W. Broberg	Lt. Hobert R. Yeager
		Lt. James D. Summers	Lt. Roy W. Camblin

Detroit-Cleveland Flying Boat Line Carrying Many Passengers

With the starting of a double daily flying boat service between the two Lake cities by the Aeromarine Airways a new chapter in the development of commercial aviation in America has commenced.

Every day, promptly at 9 A.M., one of the Aeromarine eleven passenger enclosed-cabin flying limosines leaves the airport in Detroit for Cleveland, and in the latter city another flying boat of the same type takes the air bound for Detroit. The return flight is made from both cities at 5 P.M. The flying time in this division of the Aeromarine Airways is 90 minutes as compared to 5 hours on the train.

The fare is $75 round trip and $40 one way. C. F. Redden, president of the company, through whose efforts this airway was established, stated today that as the volume of passenger traffic grew so would the rate of fare be reduced.

So popular has this new mode of travel between Detroit and Cleveland become that reservations have to be made several days in advance if seats are desired. On Fridays and Saturdays it is almost impossible to secure seats unless ample advanced notice is given the company. Four huge flying boats are used on this service. They are the famous "Santa Maria," holder of the world's record for distance flown, the "Wolverine," the "Buckeye" and the "Niagara."

The equipment at both the Detroit and Cleveland terminals is complete in every way. A luxurious house boat, from which passengers are taken aboard the flying boats, a speedy and comfortable motor launch and automobile parking space at the landing docks make air travel via Aeromarine flying boats comfortable from the moment the ticket is collected at the terminal until the passenger arrives at his destination.

As the crow flies, the distance between cities is 112 miles and an elaborate and carefully planned method of communication has been established through signal stations, en route. When the morning boat leaves Detroit, at the main operating base, it flies down the Detroit River and lands at the foot of First Street in the heart of the downtown business section where additional passengers are taken aboard. Taking the air once more the flight is continued over the river until Lake Erie is reached. At the mouth of the Detroit River is a signal tower and the exact time the flying boat passes is immediately telephoned back to Detroit. There are other signal stations en route, at Put-In-Bay, Vermillion, O., and Lorain, O. and the same procedure is followed.

With this method the boats are undre constant observation and the exact time of their arrival can be announced at the dock a half hour before the flying boat arrives.

The schedule has been maintained without interruption since the service was started and in nearly every case the boats arrive on time. In the matter of departures also the strictest attention is paid to getting the boats away on time and already several tardy pasengers, arriving a few minutes late, have been forced to realize that when a departure time is set the boat departs promptly.

Each seat in the beautiful enclosed-cabins is numbered and every passenger knows beforehand just where he will sit. This avoids unnecessary delay and confusion and prevents misunderstanding among those making the flight.

Landing Field Buildings

Types, Sizes and Cost of Buildings for Civil Aeroplane Landing Fields.

By Archibald Blank, Consulting Engineer, Garden City, N.Y.

Size of Hangars

THE sizes and shapes of hangars to be used depend entirely upon the size of machines, the operating practice and the importance of the fire risk. Before the kind of buildings to be used is decided, each of these points should be carefully considered. Information on the dimensions of the machines, likely to be used at the field, should be obtained and tabulated before any other step is taken. Construction of hangars without first assembling this data may result in either great waste of space or in the provision of hangars in which some machines arriving at the field cannot be housed. Obvious though this should be, it is quite often neglected. Table 1 gives the housing dimensions of a wide range of machines, water and land types, including military, sport and commercial. These can probably be regarded as representative of the machines likely to land at a municipal or other field in the United States.

One of the next points to be considered is the question of whether individual hangars are to be used or whether several machines are to be housed in each hangar. The former method is preferable, but has the disadvantage of requiring greater investment in buildings. The latter is more economical in cost, but increases the possible loss in the event of fire. In addition, if the hangar is to be much longer than it is wide, it will be impossible to remove machines housed in the rear without moving those nearer the door. It is this consideration which makes the deep Army hangars unsuitable for civil purposes. Where hangars are to be leased to several different parties, the single machine type of hangar is particularly desirable on account of its keeping the property of each lessee separate.

If only one machine is to be housed in each hangar, and the maximum size is definitely known, a hangar can be selected which permits the housing of this machine with a minimum clearance for each side, front and rear of 2 to 5 feet, depending upon the size of the machine. The door should be of such size as to clear the highest part of the machine (with propeller swung out of the way), with tail either up or down, by not less than 12 inches. Where more than one machine is to be housed in one hangar, scale paper layouts of the machines to be housed should be made and several arrangements tried on paper until the most economical use of space is determined. Ample clearances should be allowed to permit moving of machines. It is advisable to consider only the use of standard sizes of hangars unless the project is an extremely large one requiring a complete chain of fields. Table 2 gives the dimensions of most of the standard hangars which can be obtained in this country.

Types of Hangars

Generally speaking, hangar construction may be divided into five classes. Arranged in the order of their usual cost these are: (1) tent; (2) canvas on rigid frame, usually of wood; (3) all wood; (4) all steel and (5) the factory type of brick, steel and glass with timber roofing. The tent hangar is simply a temporary housing, being a canvas tent shaped to house the aeroplane. It should not be considered for any other purpose than emergency housing. Its value even as a temporary hangar is to be questioned. The second type, canvas on wood frame, is also temporary and more or less of a makeshift at best. Contrary to a quite general impression, it is not practicable to erect this type and later replace the canvas with wood. The frame is very light and will not carry the additional weight of the wood siding and roof.

The all-wood hangar can be regarded as a permanent type of construction and has been used to quite some extent in this country. It was, in fact, the first type to be used. This type is, however, rapidly being supplanted in public favor by the all-steel type, which has the advantage of being a lesser fire hazard. This change is due to the standardization of the steel hangar having brought its cost down to the point where it is comparable with wood and sometimes lower. The factory type of building being the most expensive type of construction, the all-steel may be regarded as the most generally suitable for hangar purposes. Table 3 gives the approximate costs, per square foot of floor space, of the construction of the various types of hangar, shop and other buildings in the eastern part of the United States. These costs are compiled with great care and can be relied upon, subject to the usual fluctuation in building costs. A substantial reduction in outlay will be obtained if the aeroplanes are finished sufficiently to withstand exposure and are stored by being fastened down to the field with cockpits, engine, propeller, etc., covered with tarpaulins. The only hangars then required will be such as are necessary for shop purposes and to house machines on which work is being done. It should be remembered that aeroplanes should be specially well weather-proofed if this practice is to be used. Another method of reducing the building investment, but which is not always practicable, is to construct hangars shaped to fit the machine instead of being rectangular. This gives a building of T-shape in plan, and, while costing more per square foot of floor, the cost *per machine* is slightly reduced.

Types of Hangar Floors

Four types of floors for hangars have been in general use to date. These are: (1) dirt; (2) cinder; (3) wood and (4) concrete. The first is entirely unsuitable and is really no floor at all. The second, properly laid and rolled, is very economical and quite satisfactory for hangers not

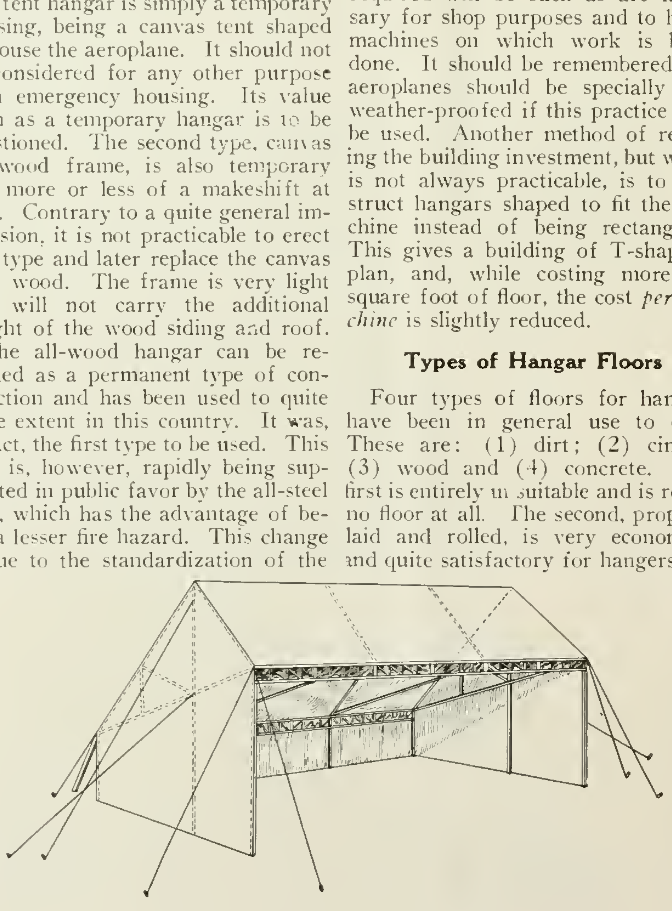

Fig. 1: Wood and Canvas Hangar Richards

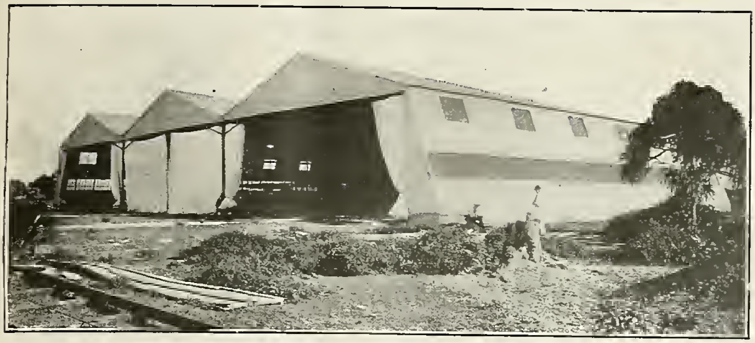

Fig 2: All Steel Hangar (Milliken) with Curtain Doors

used much as shops. It also has the advantage of absorbing gasoline or oil while providing a firm footing. While it gradually hardens with use, the surface can be restored by applying and rolling a couple of inches of additional cylinders when necessary. The last two types of floor are each very satisfactory so far as performance is concerned, but are expensive and should not be considered for most *hangar* purposes on this account. They are, however, more suitable for shop floors than the cinder type. The cinder floor is constructed by spreading clean cinders over the surface of the earth inside of the building and rolling down until firm. The finished floor should be about 6 inches thick, which will require about 9 inches of loose cinders to be spread before rolling. The 6 inches of finished floor raises the level sufficiently above the surrounding soil to ensure dryness in most cases. It may sometimes be necessary to increase this depth if the surrounding soil holds much water. The increased height can be obtained economically by filling in and rolling several inches of soil before spreading the cinders. A finished floor elevation of, say, 12 inches thus obtained can be relied upon to keep the building dry even if the surroundings are damp. Table 4 gives the approximate costs of construction for different types of floors in the eastern part of the United States. Such costs are subject to considerable variation according to local labor conditions and cost of materials. However, the figures given are sufficiently accurate for all preliminary estimate purposes.

Hangar Doors

The most important single feature of the hangar construction is the door through which the aeroplanes are moved. Several types of hangar doors are shown in Figure 5. The horizontally hinged type have been found to operate well when new, but they do not stand up under rough and constant usage. As landing field equipment is exposed to high winds, as well as being usually neglected, these types should be regarded as unsuitable on account of their liability to damage. The curtain type of door is, by far, the most economical so far as initial cost is concerned. While it requires some care also, and must be securely tied at all times, it has the advantage of being easily repaired and stands up fairly well. Where funds are limited this type of door should be used, excepting in localities where very high winds are frequent. When such doors are installed a rule should be made of always fastening the curtain whether open or closed.

The folding type and the rolling type of doors are each very satisfactory, but fairly expensive. They require less maintenance than the curtain door and are therefore cheaper in the end. For all ordinary purposes these doors can be generally recommended. The bascule door, motor operated, is probably the very best type of hangar door used. It is, naturally, the most expensive. The rolling steel shutter type of door is also a very good door, but an expensive one. It is not so convenient to operate as the bascule type, even if power for operation were to be furnished. The limits in the practical widths of the steel rolling shutters necessitates there being several of these used to close the ordinary hangar opening. This, at the same time, requires the use of folding guides which have to be swung out of the way after the shutters are raised. Whether the additional expense of these latter types of doors is justified will depend upon the particular project.

Shops and Garages

No trustworthy general rules can be laid down for the area of shop and garage space which is required at any field for a given number of aeroplanes. The Army and Navy field conditions are so different from those found at civilian fields that any figures from such sources would only be misleading. In the case of fields where hangars are provided for all of the aeroplanes, the question of shop space may usually be considered to be taken care of in the hangars themselves. There will be sufficient clear space around the machines to provide room for work benches, etc., for the repair work. There will be some exceptions to this, however. In the case of organized airlines, repair work will probably be concentrated in one building on each field in the interest of efficiency. Also in cases where the practice of fastening aeroplanes down to the field, instead of housing them, is used, one shop building of the hangar type will be necessary. In the latter case, if this building is large enough to house the largest aeroplane at the field, it can be used both for small work and assembly purposes. With civilian fields of the present capacity, this one building will be found to be amply sufficient. In the case of organized airlines no general rules can be given; each case must be worked out in detail to suit conditions.

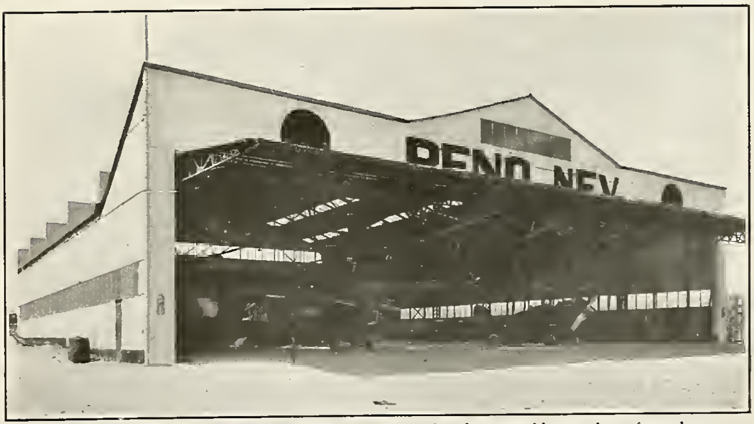

Fig. 3: Steel frame hangar with corrugated asbestos sides and roof, and with motor operated Bascule door (Straus)

The garage space necessary is subject to similar variation. In this case the best policy is probably to set aside a convenient plot for the future garage and to erect no buildings for this purpose until actually required. When the need arises, a standardized steel building meeting immediate needs should be erected, leaving space for expansion at the side and in the rear. As expansion became necessary, additional sections could be added to the original building, the former side or rear end covering being moved to the new side or end of the structure.

Table 1—Housing dimensions of typical aeroplanes (to nearest inch)

Make and Model	Width Overall		Length	Height with Propeller Horizontal	Type
	Wings on	Folded or Wings off			
LAND MACHINES					
Air Service Messenger..........	20′ 0″	7′ 0″	17′ 9″	7′ 0″	Sport or messenger
Thomas-Morse MB-7.........	24′ 0″	8′ 0″	18′ 6″	7′ 3″	Scout
Curtiss Oriole...............	40′ 9″	10′ 11″	26′ 1″	10′ 3″	Sport
DH-4..........................	42′ 6″	13′ 7″	29′ 11″	9′ 8″	Fighter
Curtiss JN-4................	43′ 7″	9′ 9″	26′ 11″	9′ 10″	Training
Curtiss 1-Engine Eagle..........	64′ 4″	17′ 6″	37′ 3″	13′ 6″	Commercial-passenger
G. L. Martin MB-2............	74′ 2″	37′ 10″	43′ 7″	15′ 7″	Bomber
WATER MACHINES					
Loening Model 23............	43′ 0″	10′ 0″	33′ 0″	8′ 9″	Sport
Aeromarine Series 40 and 50....	48′ 6″	11′ 0″	28′ 11″	12′ 7″	Sport
Curtiss Seagull..............	50′ 3″	11′ 11″	28′ 10″	11′ 9″	Sport
Curtiss HS-2, Aeromarine 80....	74′ 0″	15′ 1″	38′ 6″	14′ 7″	Naval passenger
Navy F-5-L, Aeromarine 75....	103′ 9″	19′ 6″	49′ 4″	18′ 9″	Naval passenger

NOTE: Add 12″ to 24″ to height of water types to allow for height of handling truck.

Wood flooring is much to be preferred for the shop buildings. For an assembly shop a cinder floor is quite usable, but not so satisfactory as the wood. For other shops the wood is the only really suitable floor. The planked wood floor can be considered as the most suitable for general shop purposes, while the wood block floor is most satisfactory for machine shops, engine overhaul and similar shops. For garage purposes the concrete type of flooring is the most suitable, but cinder floors are also satisfactory. The use of any type of wood floor for garage purposes is not advisable. All shops should be well lighted, both naturally and artificially. These buildings, or parts of buildings, should be heated in cold weather, otherwise the working efficiency of the staff may be expected to drop very greatly. Toilet facilities should be provided for each building if large and for each group of buildings if small. There should be modern equipment if running water is available, otherwise outhouses should be constructed in convenient locations. So far as the type of construction is concerned, shop buildings may be similar to the hangar buildings. Standardized steel buildings are particularly suitable for garage use. Dope rooms in shops should be separated, by partitions, from the rest of the building in which they are located. Such rooms should also be well ventilated directly to the outer air. If much doping is to be done, this ventilation should be obtained by the use of exhaust fans.

Space for Construction of Complete Aeroplanes

In the case of shops which are to be used for the construction of complete aeroplanes a little more information is available. This space will vary

Table 2—Dimensions of Standard Hangar and Shop Buildings

Type	Inside Width	Length	Height	Door Size	Sides	Frame	Sheeting	Remarks
Type H Bessonneau	66′ at cols. 76′ bet. cols.	79′	13′ at eaves 17′ at center	13′ high 66′ wide	Sloping	Wood	Canvas	
U. S. Air Service Wood and Canvas	66′ at cols. 75′ bet. cols.	98′	16′ at eaves 21′ at center	16′ high 66′ wide	Vertical	Wood	Canvas	
U. S. Air Service 66′ x 140′ Steel	66′	140′	14′ at eaves and center	14′ high 66′ wide	Vertical	All Steel	Galv. iron	Curtain type door
U. S. Air Service 110′ x 200′ steel	110′	200′	28′ at eaves and center	28′ high 110′ wide	Vertical	All Steel	Galv. iron	Curtain type door
Milliken, 11 ft.	20′, 40′ or 60′ 7′ addit. bet. cols. in slop. sides	Units of 20′ no limit	11′ at eaves and center	11′ high x multiples of 20′ wide	Sloping or vertical	All steel	Usually galv. iron	Any type door
Milliken, 14 ft.	20′, 40′ or 60′	Units of 20′ no limit	14′ at eaves and center	14′ high multiples of 20′ wide	Vertical	All steel	Usually galv. iron	Any type door
Milliken, 17 ft.	20′, 40′ or 60′	Units of 20′ no limit	17′ at eaves and center	17′ high multiples of 20′ wide	Vertical	All steel	Usually galv. iron	Any type door
Milliken, 21 ft.	20′, 40′ or 60′ 7′ addit. bet. cols. in slop. sides	Units of 20′ no limit	21′ at eaves and center	21′ high multiples of 20′ wide	Sloping or Vertical	All steel	Usually galv. iron	Any type door
Austin Modified No. 3 Standard Bldg.	About 48′	Multiples of 20′ no limit	13′ at eaves and center	13′ high about 48′ wide	Vertical	Steel truss and cols.	Wood roof, steel sash, brick walls	Any type door
Austin Semi-Standard	70′, 80′, 90′ and 100′	Multiples of 20′ no limit	Any	Width of Building any height	Vertical	Steel truss and cols.	Usually steel sash and brick walls	Any type door
Strauss Type "A"	100′	100′	18′	18′ high 100′ wide	Vertical	All steel	Corrugated galv. iron	Strauss bascule door operated by 5 h.p. motor
Truscon Steel Co. Type 1-S	32′, 40′, 48′, 50′ and 60′ less cols.	Multiples of 2′	8′-0″, 10′-8″, 13′-4″, 16′-0″, 18′-8″ and 21′-4″	Approx. same as bldg. height and width	Vertical	All steel	18 ga. flat copper steel	Small doors or open end only (for curtain door)
Belmont Iron Works	66′	Multiples of 20′	14′, 18′ and 28′	14′, 18′ & 28′ high 66′ wide	Vertical	All steel	Corr. steel or asb prot. metal	Steel sliding door
Belmont Iron Works	110′	Multiples of 20′	28′	28′ high 110′ wide	Vertical	All steel	Corr. steel or asb. prot. metal	Steel sliding door
Belmont Iron Works	66′	Multiples of 20′	40′	40′ high 66′ wide	Vertical	All steel	Corr. steel or asb. prot. metal	Balloon hangar Steel sliding door
Belmont Iron Works	45′	Multiples of 20′	46′	46′ high 45′ wide	Sloping	All steel	Corr. steel or asb. prot. metal	Balloon hangar Steel sliding door
Belmont Iron Works	70′	Multiples of 20′	75′	75′ high 70′ wide	Sloping	All steel	Corr. steel or asb. prot. metal	Balloon hangar Steel sliding door

Table 3—Landing field buildings. Approximate cost in the eastern part of the United States, June, 1922

Uses of Building	Type of Construction	Approx. Size	Cost per Sq. Ft. Erected		
Factory, hangar, shop or garage.	Factory type. Steel frame, brick and glass sides. Wood roof. Erected complete on concrete foundations. Without floors. Clear span, 60′ to 100′.	60′ x 100′ and up. 12-14′ high.		$1.25 1.50 in Greater New York	$1.50 1.
Hangar, shop or garage.	All steel. Standardized, galv. sides and roof, with trim and ready painted. Erected on concrete piers. No floor. Clear span to 60′.	60′ x 100′ or less. 14′ high.	Bldg., Erect.,	$0.60 .25 $0.85	$0.75 .30 $1.05
Shop, garage, stockroom, radio, etc.	Light weight, all-steel, galv., unpainted. Erected on posts. No floor.	About 20′ x 25′. 8′ high.	Bldg., Erect.,	$0.90 .20 $1.10	$1.05 .30 $1.35
Hangar, shop, garage, etc.	Large frame buildings. Wood truss, clear span to 50′. Wood siding and roof. Roof tar paper covered. Erected on posts. No floor.	Span up to 50′. Any length. 12′ high.	Mater., Erec. & paintg.	$0.40 .40 $0.80	$0.60 .60 $1.20
Office, stockroom, radio, etc.	Small wood frame buildings. Sectional type, bolt-together. Complete with all trim, partitions and ready painted. ⅞″ flooring.	12′x18′ to 18′x36′ 8′ headroom.	Bldg., Erect.,	$0.65 .15 $0.80	$1.40 .25 $1.65

NOTE: These costs based upon construction of more than one building. Slightly higher for single buildings. Subject to increase in case of poor transportation or other such conditions. Heating. water, lighting, etc., *not* included. Hangar prices include only the less expensive types of doors.

Based upon numerous estimates furnished for the purpose.

Table 4—Building flooring, heating and lighting. Approximate cost of installation in the eastern United States, June, 1922

FLOORING COSTS		Cost per Sq. Ft. in place	
CONCRETE.	4″ floor, plus 1″ finish; total, 5″	$0.18	$0.25
CINDER.	9″ steam cinders, spread and rolled manually to 6″. Cost varies greatly according to local cost of material. Probable range	.05	.10
WOOD.	9″ cinders, rolled to 6″; 3″ x 4″ creosoted sleepers; 1″ Y. P. rough sub-flooring, creosoted on under side; 1″ maple finished floor. Total cost	.33	.38
	Same floor on concrete base (4″ rough concrete)	.40	.45
WOOD BLOCK.	4″ rough concrete base. Wood blocks on edge. Total cost	.40	.45

For preliminary estimate purposes assume flooring unit cost to vary inversely with the size of building as well as with local conditions.

LIGHTING AND HEATING	Cost per Sq. Ft. of Floor Area for equipt. installed	
General shop lighting without drop lights or any special outlets, etc. Inside work only, no feeders. (Electrical)	$0.03	$0.07
Shop heating plant completely installed. Steam system. To maintain ordinary shop working temperature	.25	.40

Lighting and heating cost subject to great variation and should be considered as crude approximations. For preiminary estimate purposes the use of the higher figures is advisable.

not only with the output but also with the plant efficiency, size of machine and its type. In general, seaplanes will require more floor space than land machines and flying boats will require more space than seaplanes for their construction and for the same output. During the war a number of large aeroplane factories turned out these machines in large quantities, using the following space: Total floor space per complete machine per day in quantity production ranging from 25,000 sq. ft. for small training machines to 60,000 sq. ft. for larger single engined machines. The area required is actually quite elastic and greatly affected by the conditions mentioned above. It is reasonably safe, however, to assume for preliminary purposes that 15,000 to 20,000 sq. ft. of floor will be required in the shop for an output of one complete moderate-sized (say 3,000 pounds fully loaded) aeroplane per week if the plant is to be run at full capacity. This space should be increased with the size of the machine and should be liberally increased if more than one type of machine is to be built at the same time.

Several more or less efficiently arranged American factories show about the following average division of their floor space for construction of different types of machines. It should be safe to use these figures in the original layout of the shop, modifying the division later if it becomes necessary:

	Per cent of total shop space
Stockroom	8
Wood shop	16
Metal shop	22
Wing, etc., building	12
Assembly room	20
Dope and paint shop	8
Shipping and finished storage	8
Offices	6

Field Office and Stockroom

No matter how small the field equipment may be, some suitable heated and lighted space should be provided for office and stockroom. In the case of very small fields a 20 x 20 foot building is ample for both purposes. If some type of standardized steel or sectional wood building is used it can be extended from time to time as the field equipment expands. Many of the buildings of these types now on the market are suitable for the purpose. It will usually be found cheaper, as well as more convenient, to purchase such instead of having the local contractor erect special buildings which do not provide for the future expansion. Sectional wood buildings measuring about 18 x 24 feet, and reassembled in the field by bolting all toether. Figure 6 shows the appearance of a completed building of this type. This size of building can be erected complete by two men in about 2 to 3 days. The heating can be most conveniently obtained by the use of a small round stove. On a field where little repair or construction is done this will be all of the heating absolutely necessary. The partitions purchased with the building can be used to divide it into field office, locker room and stockroom. Where runnin water is available, a toilet can also be installed.

When our firm (A. & D. R. Black, of New York and Washington) was in operation we designed a special

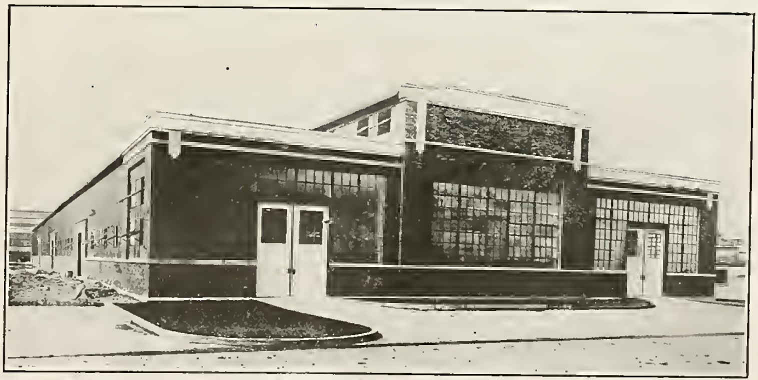

Fig. 4: Steel, Glass and Brick Type Building Austin Adapted to either Factory or Hangar use

sectional wood building for field office use which is shown in Figure 7. This building is so elastic that it became referred to in our office as the "rubber building." The arrangement is shown very completely in the illustration and little comment is necessary. The construction is started with one 20 x 20-foot unit. Additional 20 x 20-foot units are added as the need arises. The former outer wall of the first unit becomes a partition between it and the new unit as the addition is made. Once erected, no part of the building is ever moved even when extending it.

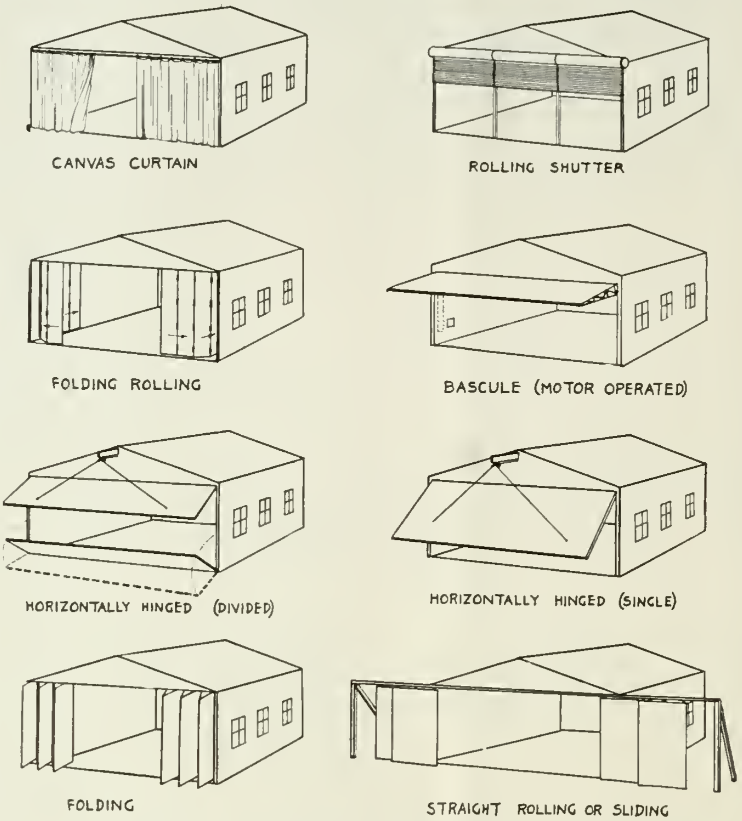
CANVAS CURTAIN
ROLLING SHUTTER
FOLDING ROLLING
BASCULE (MOTOR OPERATED)
HORIZONTALLY HINGED (DIVIDED)
HORIZONTALLY HINGED (SINGLE)
FOLDING
STRAIGHT ROLLING OR SLIDING

FIG. 5— TYPES OF HANGAR DOORS. } PRINTER— SET IN TYPE

LANDING FIELD BUILDINGS

Gasoline and Oil Houses

At any field where several different owners are likely to have machines at one time, or where any quantity of such supplies is kept on hand, some provision for storage of gasoline and oil is necessary. One of the smallest steel or sectional wood buildings may be used for this purpose. It will be found, however, that even the smallest sizes of these provide much more space than is necessary. If such buildings are used, liberal vents should be cut in the walls to avoid danger of accumulation of gas. Racks should be constructed for the oil barrels and, if gasoline is purchased in this way, for the gasoline barrels also. Shelving for grease and other supplies should be installed. If the gasoline is to be stored in an underground tank, the most satisfactory, economical and safest method, the pump should be located inside of this building with the hose connection extending outside. This method renders the gasoline inaccessible when the storage house is locked and prevents pilfering. Figure 8 shows a gasoline, oil and grease house, specially designed for the purpose by us. The drawings for this house were completely detailed and ready for use by any local contractor or the field force. While quite small, 8 x 8 feet, this house has sufficient capacity for what would be today considered a large field equipment. It was assumed that reserve oil barrels would be kept outside unopened in the event of a large supply being kept on hand. Oil and gasoline houses can, very often, be built by the field force out of lumber from wing crates.

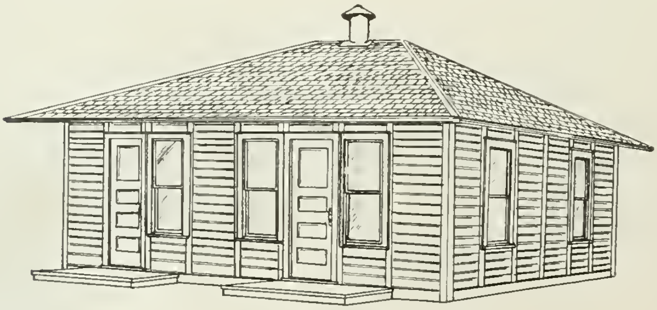

Fig. 6: Sectional Wood Buildings (Sears Roebuck & Co.)

Miscellaneous Buildings

For special purposes such as barracks, remote controlled radio stations, dead storage, lunch rooms, etc., one or other of the standard steel or sectional wood buildings on the market will usually be found suitable. For gate-houses, either one of the small sectional buildings may be used or the local contractor or field men could build a one-man box for the shelter of the gateman. It is unlikely, however, that there will be any gateman to worry about at most of the fields to be considered in the near future. In cases where toilet facilities are not installed in the field office building, shops or hangars, one or more latrines should be located on the property. Knocked-down buildings, designed for this purpose, can be purchased for about $45, which is probably less than it would cost to have them built by a local contractor It is also likely that wing crate lumber, available at the field, may be used considerably for the construction of these miscellaneous special buildings.

Planning for the Future

In the selection of buildings for landing fields, as well as in the general arrangement of these fields, every

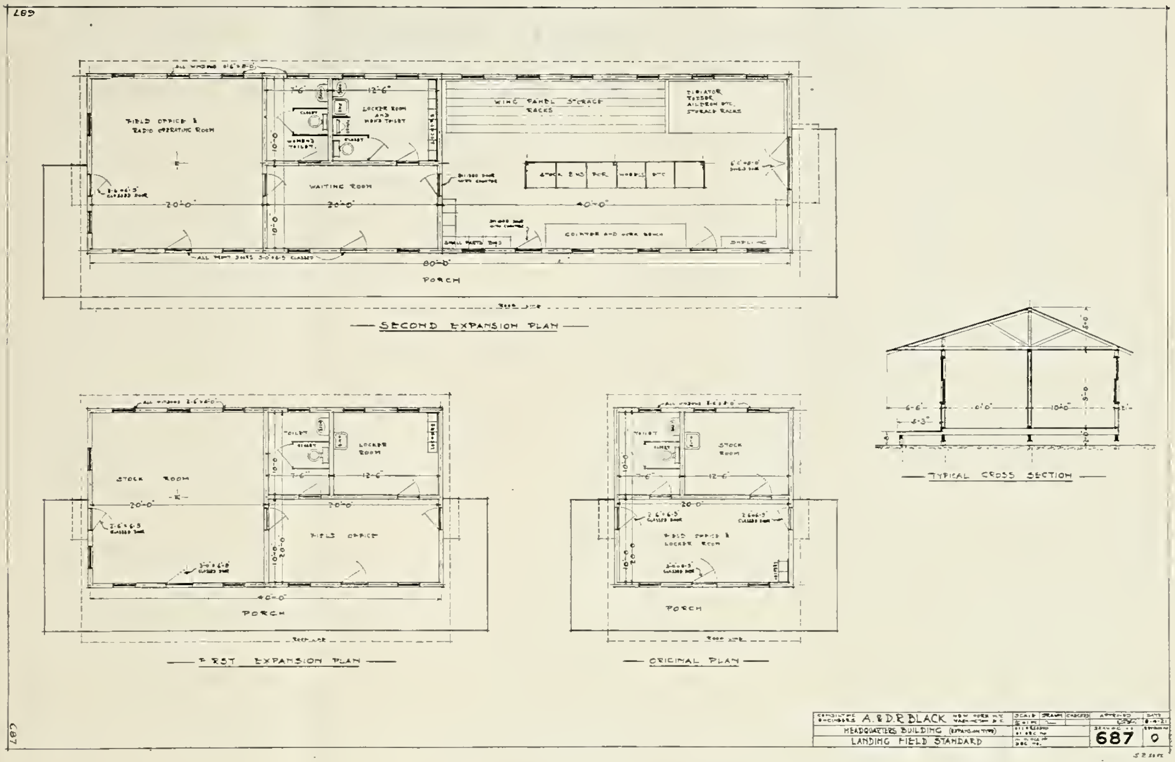

Fig. 7—Expansion Type of Field Building

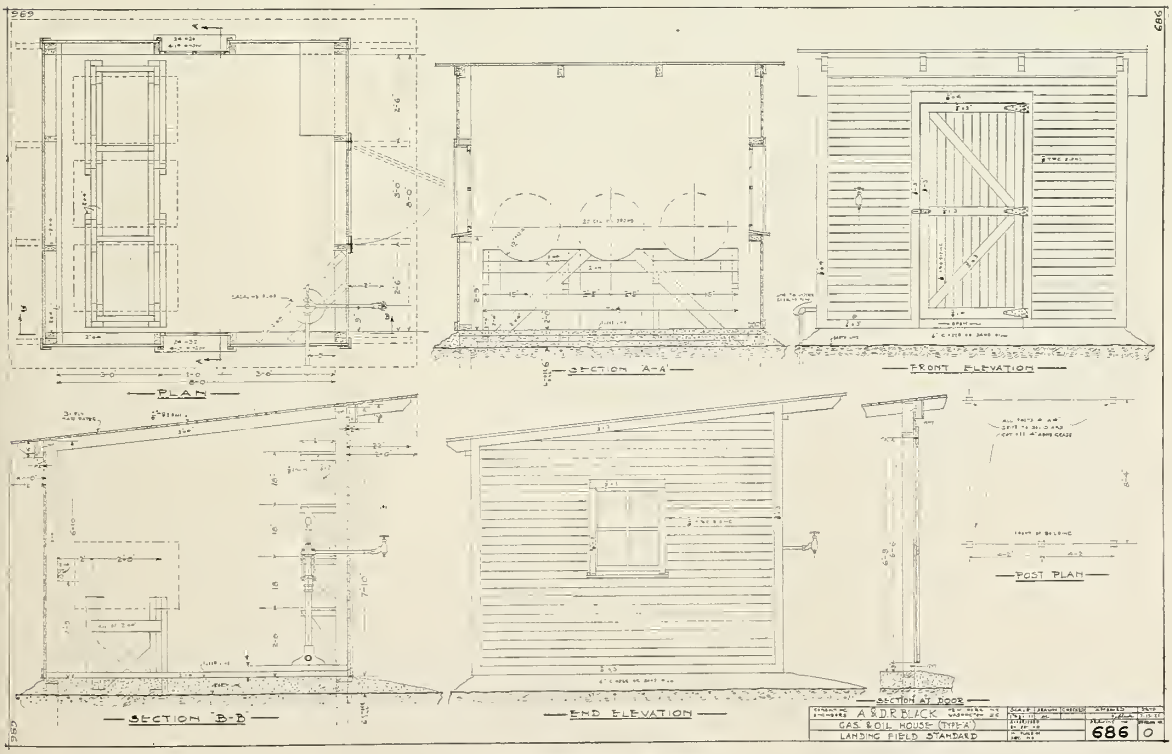

Fig. 8—Gasoline and Oil House

The Prediction of Propeller Characteristics from the Blade Element Analysis

By William H. Miller, M. Sc., Curtiss Aeroplane and Motor Corporation

Introduction

THE determination of the performance of the engine-propeller combination is closely connected with the problem of predicting the performance characteristics of a given propeller. If tests on the model of the propeller are available, one needs only to combine its characteristics with those of the engine. When no model test can be made, the propeller characteristics must be predicted analytically. The latter problem is principally one of finding the secondary angles of attack of the propeller when the blade angles and section aerodynamic characteristics have already been found.

A propeller is said to operate under *primary* conditions when the angles of attack of the blade sections correspond to those chosen for the design conditions. When the angles of attack are altered due to a different combination of forward speed and revolutions than that for which the blade angles were determined, the propeller is said to operate under *secondary* conditions.[1]

If we ignore the effect of compressibility, the thrust and torque of an airscrew are functions of

Velocity of translation, V
Revolutions in unit time, n
Diameter, D
Absolute density of air, $\rho = \frac{\delta}{g}$

where δ is the specific weight of the air, ρ the absolute density, and g the gravitational acceleration.

By dimensional theory it is proved that

$$\text{(Thrust)} \quad T = \rho n^2 D^4 f\left(\frac{V}{nD}\right) \qquad (1)$$

$$\text{(Torque)} \quad Q = \rho n^2 D^5 F\left(\frac{V}{nD}\right) \qquad (2)$$

The efficiency, η, is obviously a function only of $\left(\frac{V}{nD}\right)$, that is

$$\eta = \phi\left(\frac{V}{nD}\right) \qquad (3)$$

The functions f and F are usually termed respectively the thrust and torque coefficients. They are defined by

$$T_c = \frac{T}{\rho n^2 D^4} \qquad (4)$$

$$Q_c = \frac{Q}{\rho n^2 D^5} \qquad (5)$$

Dr. Leonard Bairstow has found that over the usual working range of an airscrew the following formulas hold very approximately true:

$$T_c = a - bJ^2 \qquad (6)$$
$$Q_c = c - dJ^3 \qquad (7)$$

where a, b, c and d are constants for a particular airscrew, and in which we use the abbreviation $J = \left(\frac{V}{nD}\right)$. The test for the validity of (6) is to plot T_c against J^2 to see how closely the curve follows a linear law; and for (7) to plot Q_c against J^3.

In Table I we give the characteristics and computed values for a two-blade propeller of typical form: Durand No. 116 (Report No. 64, National Advisory Committee for Aeronautics). The values of T_c and Q_c are expressed by Durand in the forms

$$T_c = \frac{T}{\delta V^2 D^2} \text{ and } Q_c = \frac{Q}{\delta V^2 D}$$

and we have transformed these coefficients into the forms of (6) and (7) by multiplying by 9.8 J^2, as the coefficients used in the above-mentioned report are expressed in terms of metric, gravitational units The curves are given in Fig. 1.

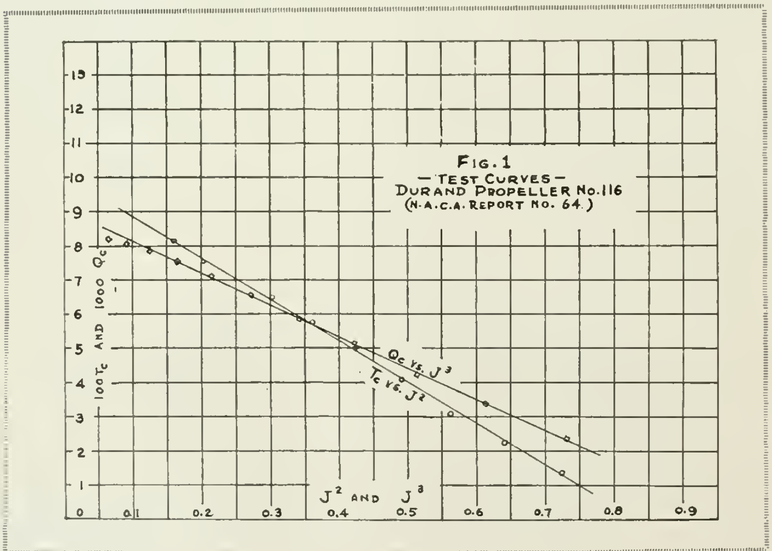

FIG. 1
— TEST CURVES —
DURAND PROPELLER No. 116
(N. A. C. A. REPORT NO. 64.)

We also give in Table II and Fig. 2 the data and curves for a model of the four-blade propeller for the B.E. 2c, the characteristics of which are taken from Reports and Memoranda No. 344 of the Advisory Committee for Aeronautics (Great Britain.) In this case the curves show that Bairstow's equations are valid for an airscrew operating in the presence of the machine.

It is now evident that by estimating the thrust and torque of a propeller for primary conditions and, also, for some arbitrary value of J within the working range[2] we can at once determine the unknown constants a, b, c and d from the resulting four simultaneous equations. If the primary and secondary conditions, respectively, be designated by subscripts 1 and 2, we find:

$$\left.\begin{aligned} a &= \frac{T_{c_1}J^2_2 - T_{c_2}J^2_1}{J^2_2 - J^2_1} \\ b &= \frac{T_{c_1} - T_{c_2}}{J^2_2 - J^2_1} \\ c &= \frac{Q_{c_1}J^3_2 - Q_{c_2}J^3_1}{J^3_2 - J^3_1} \\ d &= \frac{Q_{c_1} - Q_{c_2}}{J^3_2 - J^3_1} \end{aligned}\right\} \qquad (8)$$

Then, knowing a, b, c, and d, we can plot the thrust and torque coefficients versus J. The efficiency is found as follows:

$$\text{(Brake Power)} \quad P_m = 2\pi nQ = 2\pi\rho Q_c n^3 D^5$$
$$\text{(Thrust Power)} \quad P_u = TV = \rho T_c V n^2 D^4$$

Hence

$$\text{(Efficiency)} \quad \eta = \frac{T_c}{2\pi Q_c} J \qquad (9)$$

which is also plotted against J.

Résumé of Propeller Theory

In the case of the airscrew having forward motion, it is convenient to consider the velocity in the slip stream relative to that of the undisturbed air. Fundamentally the increase of velocity as one moves down stream is due to the difference of pressure fore and aft of the disc caused by the circulation around the blades. Once in motion, the air (possessing considerable inertia) tends to remain in motion; and there results a general superposed inflow which must be taken into account when determining the velocity of the air relative to the blades

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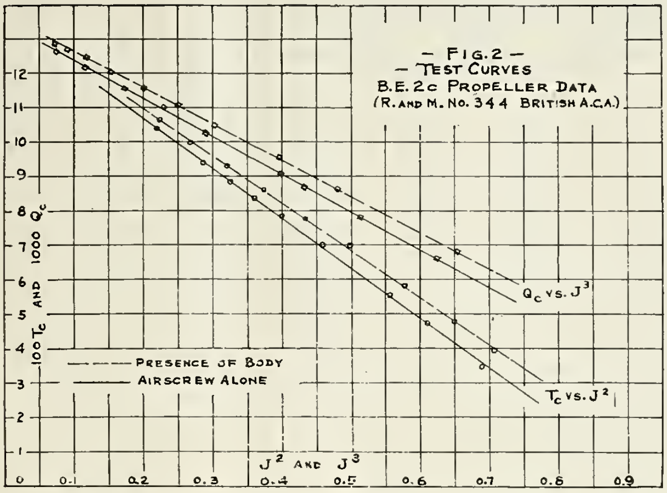
[1] Refer to "The Design of Screw Propellers for Aircraft," H. C. Watts.

[2] The working range for J seldom exceeds 0.45.



– FIG. 2 –
– TEST CURVES
B.E. 2c PROPELLER DATA
(R. AND M. No. 344 BRITISH A.C.A.)

In examining the flow at a point in the stream, it is well to note that the total induced velocity at that point is due to the action of all the elements of the N blades of the propeller. For example, the flow at a point a given radial distance from the axis is not due simply to the action of a single blade element, at the same radius; but it is actually due to the action of all the elements on all blades. In the vortex theory one considers this velocity as being induced by the whole vortex system.

Let U be the general stream velocity of a mass of air passing through a small portion of an annulus of the disc. Apply the equation of d'Alembert for the accelerating force,

$$dF = dM \frac{d^2x}{dt^2}$$

Write $U \dfrac{dU}{dx}$ for $\dfrac{d^2x}{dt^2}$ and we have

$$dF = dM \cdot U \cdot \frac{dU}{dx}$$

Separating variables,

$$dF \cdot dx = U \cdot dM \cdot dU$$

We integrate between the limits of maximum and minimum velocity in the slip stream; thus:

$$\int\!\!\int dF\, dx = \tfrac{1}{2}\, dM\, (U^2_{max} - U^2_{min})$$

But $\displaystyle\int\!\!\int dF\, dx$ is the work done in unit time, and is equal to the product of the air reaction in the disc and velocity in the disc:

$$\int\!\!\int dF\, dx = dM\, U_d\, (U_{max} - U_{min})$$

when U_d is the velocity in the disc. Then we have the resulting relation

$$U_d\, (U_{max} - U_{min}) = \tfrac{1}{2}\, (U^2_{max} - U^2_{min})$$

Whereupon cancelling out the factor $(U_{max} - U_{min})$ we obtain

$$\frac{U_d}{(U_{max} + U_{min})} = \tfrac{1}{2}$$

Now U_{min} is equal to the velocity of the undisturbed air. Then if

$$U_d = U_{min} + k'U_{min}$$

and

$$U_{max} = U_{min} + k''U_{min}$$

we immediately find that

$$k'/k'' = \tfrac{1}{2}$$

Which means that half the added velocity is reached at the disc.[3]

If we neglect the small radial component of the added velocity, we can consider the total acceleration of the fluid as being composed of two components perpendicular and parallel to the propeller disc. These we term the *axial* and *rotational* components of the *slip*. Let the proportion of axial slip to velocity of advance be designated by a and the ratio of rotational slip to peripheral speed be designated by b; then the resultant velocity of the air relative to the blade is given in magnitude and direction by

$$V_r = \sqrt{(2\pi rn)^2(1 - b/2)^2 + V^2(1 + a/2)^2} \qquad (10)$$

$$\tan\phi' = \frac{V(1 + a/2)}{2\pi rn(1 - b/2)} = \frac{1 + a/2}{1 - b/2} \tan\phi \qquad (11)$$

where, as shown in Fig. 3, the resultant velocity is denoted by V_r, and the effective pitch angle defined by

$$\phi = \arctan \frac{V}{2\pi rn}, \qquad (12)$$

r being the radius on the blade.

The differentials of thrust and torque are obtained by resolving the elemental total reaction at any radius into components perpendicular and parallel to the airscrew disc:

$$dT = dR \cos\, (\phi' + \gamma)$$

$$\frac{dQ}{r} = dR \sin\, (\phi' + \gamma)$$

where γ is the angle between the resultant reaction dR and the normal to V_r; that is, if we separate the total reaction into components perpendicular and parallel to V_r; then, as shown in Fig. 3,

$$\frac{dR_D}{dR_L} = \tan\gamma$$

The flow around a propeller blade is quite similar to that around an aerofoil wing. The thrust is developed due to circulation. Vortices peel off the tips of the blades and dispose themselves over the slipstream boundary. We will therefore assume that the components dR_L and dR_D may be determined by expressions of the forms

$$dR_L = \rho\, C_L\, (c\, dr)\, V^2_r$$

$$dR_D = \rho\, C_D\, (c\, dr)\, V^2_r$$

where C_L and C_D are, respectively, the lift and drag coefficients of the particular blade element of chord c and area (c dr). The differentials of thrust and torque may then

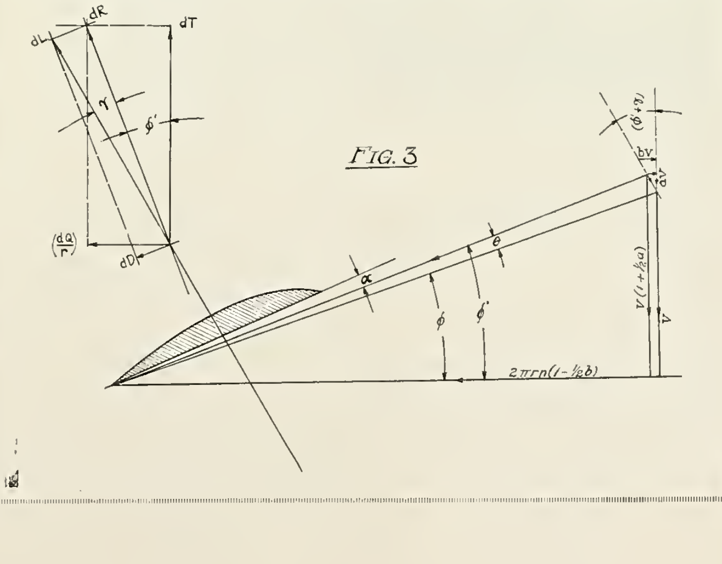


FIG. 3

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[3] Refer to "The General Theory of Blade Screws," by George de Bothezat, N.A.C.A. Report No. 29, for a more complete proof of this last relation.

be written down in the following forms: we have per element per blade,

$$dT = \rho C_L \sec\gamma\, c(1 + \tfrac{1}{2}a)^2 V^2 \csc^2\phi' \cos(\phi' + \gamma)\, dr \qquad (13a)$$

$$dT = \rho C_L c\, (1 + \tfrac{1}{2}a)^2 V^2 \csc^2\phi' \cos\phi' (1 - \tan\phi' \tan\gamma)\, dr \qquad (13b)$$

$$dQ = \rho C_L \sec\gamma\, c(1 + \tfrac{1}{2}a)^2 V^2 \csc^2\phi' \sin(\phi' + \gamma)\, r\, dr \qquad (14a)$$

$$dQ = \rho C_L c (1 + \tfrac{1}{2}a)^2 V^2 \csc^2\phi' \sin\phi' (1 + \cot\phi' \tan\gamma)\, r\, dr \qquad (14b)$$

It is, of course, necessary to evaluate either dT or dQ by only one of the above formulas, as we can make use of the obvious relation

$$\frac{dQ}{r} = dT \tan(\phi' + \gamma) \qquad (15)$$

The thrust of the blade elements at a given radius may be equated to the thrust produced by the change of momentum of the air passing through the annulus of the disc. This momentum thrust per blade is equal to

$$dT = \frac{2\pi r}{N} (1 + \tfrac{1}{2}a) a V^2 dr \qquad (16)$$

where N is the number of blades.

One must exercise care in writing down the relationship between the torque of the blade elements and the rate of change of angular momentum of the fluid, as the frictional forces are so large that they cannot be ignored. For our purposes we will not be required to seek the relation.

Let us assume that the fluid reaction in the disc is opposite and parallel to that of the blade element. It does not immediately follow that the total average slip,

$$\sqrt{(aV)^3 + (2\pi rnb)^2},$$

is opposite and parallel to dR; but it can be shown that, for high speeds of forward motion, when the contraction of the slipstream is small, we can write with sufficient approximation,

$$\tan(\phi' + \gamma) = \frac{2\pi rnb}{aV} = \frac{b\cot\phi}{a} \qquad (17)$$

We now proceed to evaluate ϕ', which is also defined by

$$\phi' = \phi + \theta \qquad (18)$$

θ being the "slip angle." First equate (13b) and 16). We will obtain the equation

$$\frac{Nc}{2\pi r} C_L = \frac{a\tan\phi' \sin\phi'}{(1 + \tfrac{1}{2}a)(1 + \tan\phi' \tan\gamma)} \qquad (19)$$

Let the ratio of total blade width to circumference, at any radius, be designated by m; that is

$$\frac{Nc}{2\pi r} = m \qquad (20)$$

Then we obtain

$$\frac{a}{(1 + \tfrac{1}{2}a)} = \frac{m C_L (1 + \tan\phi' \tan\gamma)}{\tan\phi' \sin\phi'} \qquad (21)$$

The quantity a can be evaluated by means of (11), (12), and (17); from which we find that

$$a = \frac{2\cot\phi' (\tan\phi' - \tan\phi)}{1 + \tan\phi' \tan(\phi' + \gamma)} \qquad (22)$$

TABLE I.

DURAND PROPELLER NO. 116

Report No. 64 National Advisory Committee for Aeronautics.

J	J^2	J^3	T'_c	Q'_c	T_c	Q_c
.40	.1600	.064	.0518	.00522	.0815	.00820
.45	.2025	.091	.0380	.00405	.0756	.00804
.50	.2500	.125	.0285	.00321	.0700	.00787
.55	.3025	.166	.0219	.00255	.0650	.00756
.60	.3600	.216	.0164	.00202	.0579	.00713
.65	.4225	.274	.0120	.00157	.0498	.00650
.70	.4900	.343	.0084	.00124	.0404	.00595
.75	.5625	.422	.0056	.00094	.0310	.00518
.80	.6400	.512	.0036	.00068	.0227	.00426
.85	.7225	.614	.0019	.00047	.0135	.00336
.90	.8100	.729	.0008	.00030	.0065	.00238

NOTE: $T_c = 9.8T'_c \left(\frac{V}{nD}\right)^2 = 9.8T'_c J^2$

TABLE II

PROPELLER FOR THE B. E. 2c.

Reports and memoranda No. 344, Advisory Committee for Aeronautics.

Data for Airscrew Alone.

J	T_c	J^2	J	Q_c	J^3
.469	.1041	.220	.423	.01262	.075
.535	.0941	.286	.489	.01219	.117
.570	.0885	.325	.558	.01157	.173
.600	.0836	.360	.611	.01100	.228
.632	.0784	.399	.662	.01027	.290
.677	.0702	.458	.735	.00909	.397
.685	.0687	.469	.756	.00870	.432
.747	.0555	.558	.800	.00781	.512
.770	.0500	.594	.854	.00661	.623
.781	.0475	.610			
.829	.0349	.687			

Data for Airscrew in Preseice of Model.

J	T_c	J^2	J	Q_c	J^3
.475	.1064	.225	.416	.01280	.072
.518	.0998	.268	.442	.01268	.086
.565	.0930	.319	.494	.01236	.120
.611	.0861	.373	.534	.01203	.152
.661	.0778	.436	.585	.01158	.200
.705	.0699	.497	.630	.01107	.250
.760	.0586	.577	.672	.01051	.303
.805	.0479	.648	.734	.00954	.395
.840	.0395	.705	.783	.00862	.480
			.880	.00652	.681

We then obtain

$$\frac{a}{1 + \tfrac{1}{2}a} = \frac{2\cot\phi' (\tan\phi' - \tan\phi)}{1 + \tan\phi \tan(\phi' + \gamma)} \qquad (23)$$

Since, in determining the thrust and torque we make use of the quantity $V(1 + \tfrac{1}{2}a)$, we note from (12) that

$$V(1+\tfrac{1}{2}a) = 2\pi rn \tan\phi' \frac{[1+\tan\phi\tan(\phi'+\gamma)]}{[1+\tan\phi'\tan(\phi'+\gamma)]} \qquad (24)$$

which formula gives the axial velocity of the air relative to the blade element.

After equating (21) and (23) we finally obtain the equation

$$\frac{mC_L}{2} = \frac{\sin\phi' \tan(\phi' - \phi)}{1 - \tan\gamma \tan(\phi - \phi)}$$

Or, since $\phi' - \phi = \theta$,

$$\frac{mC_L}{2} = \frac{\sin(\phi + \theta)\tan\theta}{1 - \tan\theta\tan\gamma}$$

Since θ and γ are both small angles (neither exceeding 6° or 8° over the working range, and usually having values less than 5°) we can safely neglect the term $\tan\theta\tan\gamma$ and write approximately,

$$\frac{mC_L}{2} = \sin(\phi + \theta)\tan\theta \qquad (25)$$

Aerodynamical laboratory experiments have shown that over a range of angles of attack, α, measured from zero lift of the aerofoil, to within about 4° of maximum lift, we can write very approximately

$$C_L = k\alpha$$

where k is the constant slope of the lift curve when plotted against angle of attack. If the total blade angle referred to the zero lift line of the section be designated by β_o, then the angle of attack of the section, measured with reference to the zero lift line is

$$\alpha = \beta_o - \phi - \theta)$$

We can therefore write (25) as

$$(\beta_o - \phi - \theta) \text{——} = \sin(\phi + \theta)\tan\theta \qquad (26)$$

Under the primary conditions for which the airscrew is designed, the angles of attack are usually arbitrarily fixed, and the slip angles and blade angles are unknown. The blade angles (except for the adjustable pitch propeller) remain fixed throughout the working range and hence the slip angles and angles of attack are to be determined for secondary conditions.

To solve (25), we recall that θ is a small angle and use the approximations

$$\sin\theta = \tan\theta = \theta$$

$$\cos\theta = 1$$

Then an ordinary quadratic in θ is obtained,

$$\theta^2 + \theta\tan\phi - \frac{mC_L}{2\cos\phi} = 0$$

Expressing θ in degrees, we find

$$\theta = 28.65 \tan\theta \left[\sqrt{1 + \frac{2mC_L}{\cos\phi\tan^2\phi}} - 1\right] \qquad (27)$$

Which formula is used for evaluating the slip angle for primary conditions, since C_L, m, and ϕ are all known.

In order to determine the secondary values of θ we proceed exactly as before, using (26). We find that, if k is taken in absolute units per degree, the quadratic obtained is

$$\theta + 57.3\mu\theta - 57.3^2\left[\frac{mk(\beta_o - \phi)}{2\cos\phi}\right] = 0$$

where we use the notation

$$\mu = \tan\phi + 28.65\frac{mk}{\cos\phi} \qquad (28)$$

The solution is

$$\theta = 28.65\mu\left[\sqrt{1 + \frac{2mk(\beta_o - \phi)}{\mu^2\cos\phi}} - 1\right] \qquad (29)$$

(To be continued)

The Curtiss Sail Plane

Introducing a New Sport to America

FOR two periods of thirty seconds each, on Sept. 6, Glenn H. Curtiss remained aloft in his new sailplane of silk, wood and duralumin which he believes will eventually rise without motive power from the surface of the sea.

The tests were preliminary and purely experimental. There was no intention nor effort to establish a record and the results consequently appear all the more significant. Mr. Curtiss expressed himself as highly gratified with the manner in which the craft handled and declared that continued trials, day by day, would be made.

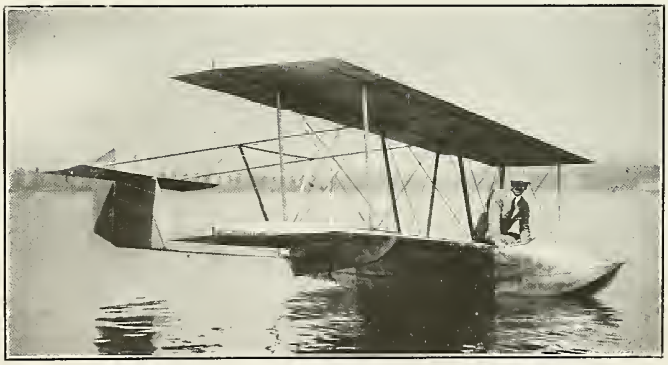
The demonstration was off Plum Beach, Port Washington, Long Island. There were present but a few people, officials of the Curtiss Aeroplane and Motor Corporation, the Aeronautical Chamber of Commerce and the Aero Club of America, and representatives of the press. There was practically no wind, shortly after 10 o'clock in the morning, when the sailplane was towed to the scene from the hangars of Lieut.-Comm. David McCulloch, in Port Washington Harbor.

The event was of extraordinary interest. Coupled with the international attention which is being given to gliding and sailing, was the fact that this marked the return of Mr. Curtiss to practical, actual flight. For five years of so Mr. Curtiss had not piloted a plane. His conviction that the flying boat could be adapted to sailing, thereby lessening the horse-power and decreasing the cost of operation, led to continued experiments in the Curtiss research laboratory at Garden City, under his personal supervision. The seaplane, being his own development, it was natural that he should reserve to himself the privilege to fly it first.

With Mr. Curtiss on Plum Beach was W. L. Gilmore, chief engineer of the Curtiss Aeroplane and Motor Corporation. Mr. Gilmore in a bathing suit, acted as assistant in the rather delicate undertaking of getting the sailplane towed properly and into the air. The towing was done by a speed boat, equipped with one of the Curtiss O X engines. Due to the excessive calm, difficulty was experienced with the towing cord, which snapped several times. But on the third towing trial, at a height of 20 or 30 feet, Mr. Curtiss cast loose, and, in spite of the dead air, sailed for half a minute. The ease of control was evident. The craft was equipped with the shoulder system of control, which Mr. Curtiss utilized in the early days of flying.

After a number of trials it became apparent that further effort at that point would be futile and preparations were made for the return. It was on this trip that the surprising developments came. It is about two miles from Plum Point to the McCulloh hangar. It took the speed boat about five minutes to make the trip. A cross breeze of slight velocity arose and for half the distance, Mr. Gilmore, sitting in the speed boat, literally "held" Mr. Curtiss and the sailplane in his hand. The plane "floated" along with only an occassional pull from Mr. Gilmore. At the end of the trip, Mr. Curtiss cut loose and "sailed" to the entrance of the hangar.

The Curtiss sailplane is a miniature N. C. boat, the huge craft which were the first to fly the Atlantic. Its dimensions are—Weight (empty) 150 pounds; loaded (one man), 310 pounds; span, 28 feet; chord, 60 inches; gap, 54 inches; length over all, 22 feet 11 inches; wing area, 267.5 sq. ft; hull, 13 feet 2-¼ inches long, 30-inch beam. The hull is made of duralumin. The glider is designed to fly at twenty miles an hour.



The Curtiss Sailplane

The Latest Commercial Machine for Economic Transportation

THE airplane illustrated below was designed and constructed at Omaha, Nebraska, by Mr. G. M. Bellanca, assisted by a number of business and professional men interested in the development of aviation.

The machine has been under almost continual test performance since the beginning of June, including attendance and participation in Airplane Meets in three States, including the Monmouth Meet in Illinois and the Tarkio and Norfolk Meets in Missouri and Nebraska.

The remarkable performance of this machine has created much interest in aeronautical circles and places the ship in a class among the best designed monoplanes of the day.

The general specifications of the Bellanca C F-5 are as follows:

Type—Cabin monoplane carrying four passengers and pilot.

Span upper plane	40 ft.
Span lower plane	22 ft.
Chord lower plane	6 ft. 6 in.
Total wing area	290 sq. ft.
Length overall	23 ft. 10 in.
Heighth over all	7 ft. 7 in.
Weight empty	950 lbs.
Useful load	1040 lbs.
Weight loaded	1990 lbs.
Weight per sq. ft.	6.85 lbs.
Pay load, exclusive of gas and oil for 600 miles, and pilot	680 lbs.

Performance.

Light load 1200-lbs.

Max. Speed	109.8 M. P. H.
Min. speed	40-M. P. H.
Speed Range	3.7 to 1
Climbing rate per min	1100
Climb in 10-minutes	7000-ft.
Min. effective hp. required for horizontal flight	14-H. P.

Full Load

Max. speed	108-M. P. H.
Min. speed	40-M. P. H.
Climbing rate per minute	600-ft
Climbing in 10-minutes	5000-ft.
Min. effective H. P. required for horizontal flight	31-H. P.

Gliding angle	12 to 1
Capacity of tanks (oil and gas)	38-gal.
Fuel consumption at full speed (oil and gas)	9.5-gal. per hr.
Range, full speed	440-miles
Range, cruising speed	600-miles
Miles to gallon of fuel (oil and gas)	16-miles

Some of the note-worthy features embodied by this plane are—its simplicity of design, absence of wires, lightness, economy, quick take-off, low landing speed, high speed attained with a large pay load—low cost of manufacture, maintenance and operation.

Motor

The motor used is an Anzanni 90-H. P. with ten air-cooled cylinders, weighing 385-lbs. Two magnetos,-a Zenith carburetor and double air pump was used. Although the cylinders project a minimum distance from the hood, thereby reducing the parasite resistance, no overheating has been experienced after three-hour periods of continuous flying.

The propeller, especially designed by Mr. Bellanca, is 8-ft. diameter and 8-ft. pitch, mounting at the center an aluminum spinner with louvers, for cooling central parts of the engine.

Wings

The spars are I-section of Port Orford cedar, and project from the inner end of the wings 20 inches, thus forming an attachment of wings to the fuselage. The construction at the center is such that the compression stress is continuous without being transferred through the fuselage.

The wing ribs are a combination of ash, bass wood and cloth, weighing nine-ounces each, and have sustained a sand loading of 700-lbs. each.

The lower wings are much smaller than the main wings, and are attached at intermediate points to the upper wings which cantilever beyond these points.

Fuselage

The fuselage is of box girder construction, having a good steam line form internally reinforced with cables and wires. The cabin accommodates four passengers, although two additional passengers may be carried.

The engine compartment is separated from the passengers in order to be more conducive to comfort.

Three windows are provided on each side of the cabin, and one in front.

Tail Group and Controls

The empennage consist of a fixed stabilizer, to this are fastened the elevator flaps.

The oval shaped rudder with sufficient area insures complete control under all circumstances in landing. Rudder is operated by a foot bar, while the lateral and longitudinal balance is operated by stick control.

Landing Gear

The chassis consist of two ash stream line struts glued together with birch veneer, forming the V shaped type—the whole in combination with the shock absorbers form a light simple construction.

Various Factors and Strength of Parts

The fuselage is designed to take a load of 35-lbs. per sq. ft. at the tail surfaces, stabilizers and elevators with a factor of 2 and proved by various test.

Stabilizers and elevators are made to stand a load of 50-lbs. per sq. ft. and the rudder a load of 35-lbs. per sq. ft.

The landing gear has a factor of 8.

The factor at the cantilever on wings in rear spar is 9—the weakest point, while the front spar at this point is 10.5.

The factor for reverse air load is 5.5. The factor for load lifting on $\frac{1}{4}$-in. cables is 14.

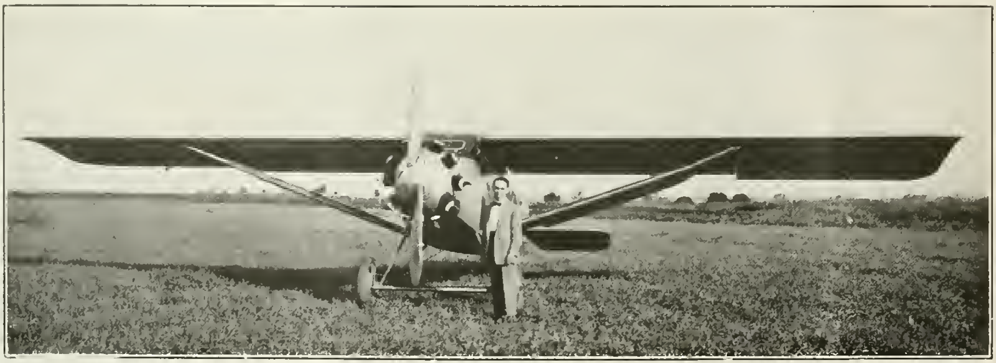
L. D. on upper wing is 20; L. D. on lower wing is 16.4.

L. D. combined wings (upper and lower wings) and resistance of wires and struts is 18. The advantage of this combination compared with internal braced wings may be readily seen.

Actual Performance

This machine won first prize in four contests at Monmouth, Illinois. It covered in the speed contest the 15-mile triangular circuit in 9-min. 15-sec. The second best machine with 150-H. P. motor covered this course in 11-min. 30-sec. This course was covered in another contest by an S. V .A. (220-H. P. SPA) in 8-min. 33-sec.

The trip from Fort Crook to Mon-



The Bellanca C-F 5

mouth via Des Moines, 301-miles, was made in 3-hrs. 11-min. against a head wind, averaging 95-miles per hour, with a consumption of 21.5-gal. of gasoline.

This machine made a cruising speed on this trip of 95-miles per hour, with 14-miles per gallon of gasoline. Without the head wind this machine makes 16-miles to a gallon of gasoline.

The Bellanca CF in the gliding contest required 4-min. 43-sec. to descend from an altitude of 2,000-ft. covering a distance of 4-½-miles with a gliding ratio of 12 to 1. The nearest competitor required 3-min. 44-sec.

The climbing contest showed that the Bellanca CF climbed 7,000 ft. in 11-min with a 150-h. p. motor attained only 6,000-ft. in 14-min. While the third machine attained only 5600-ft. in 12½-min.

The Bellanca CF can be assembled ready to fly in 30-minutes due to its simplicity of construction.

The machine participated in two other Meets, one at Tarkio, Mo., and the other at Norfolk, Neb. At Tarkio the machine won 1st prize in three events entered, which were silver cups and at Norfolk it won 1st prize in all the flying events of the Meet; namely one silver cup and $400 cash. In many events at Norfolk the machine showed better performance than it did in the Monmouth Meet.

Aeronautic Progress in Canada

By E. G. Wilson

THE question of civil aviation is receiving no little attention in best be illustrated by a reference to the work being done by the Canadian Air Board in preparing mosaic maps of industrial regions and large engineering projects. The main purpose of the air service in Canada is to develop and train aviators to meet the needs of national defence in the future, and for that purpose a great deal of experimental work and training of men in air operations has to be carried out. It has been found feasible to promote this training simultaneously with performing valuable services to the civil branches of the government and to the cities and towns. In the reports of the Air Board it is shown that it carries out experimental aerial surveys and considerable research work in connection with the development of aerial photography.

The board rendered considerable service to those who are making a study of the project to deepen the St. Lawrence river, and to create a vast supply of hydro electric energy for use of the United States and Canada. It has made mosaic maps of important industrial areas and large canals. It has provided maps of cities and towns for the purpose of facilitating the work of preparing comprehensive plans of urban developments. These mosaic maps cover the whole of the metropolitan areas surrounding cities. The oblique photographs which can be obtained in England are interesting, but are not nearly so valuable for practical purposes as the mosaic maps taken vertically from the air. These maps are not accurate enough to take the place of the ground survey, but are of great value in giving details and in presenting a bird's eye view of physical conditions.

Recently, when the project of changing the Air Board into the defence ministry was before the Government, Mr. Thomas Adams, town planning adviser to the Canadian government, submmitted a statement to Premier W. L. Mackenzie King, drawing attention to the valuable work which the Air Board had done, and was doing. In this statement attention was drawn to an aerial survey that was being made of a proposed national park. It was indicated that the survey would save a considerable sum of money, and give an impression of the country that would be unobtainable by any other means. The premier replied that he was sure the ministry of defence would be the first to see that any changes would not operate against the fullest utilization of the air services for civil purposes.

The widespread aerial activities in Canada show that flying is no longer an exceptional feat, but is becoming gradually an ordinary phase of transportation. The steady progress made by the firms employing aircraft as a subsidiary to their main operations is perhaps the most gratifying of the operations during the past year. In the province of Quebec several of the large pulp and paper companies are now employing aircraft regularly in connection with their forestry work, for survey, fire protection and transportation within their limits. The success attending such developments gives promise of a steady outlet for commercial flying.

In its annual report, just recently issued, the Air Board has the following to say concerning the present status of civil and commercial flying operations in the Dominion: "Considering the progress as a whole there is no need for discouragement. Aviation is passing through a normal phase of its development. The boom period following the war is dying down. Consolidation is taking place and experience is showing those operations which will prove not only profitable, but of value to the community as a whole. This phase will continue for a further period of years, during which the more temporary phases of flying will disappear and useful forms of work will be gradually developed. The opportunities for commercial flying in Canada, are unequalled in any part of the world. Development takes time and financial conditions are adverse, but those interested in aviation may look forward with confidence to steady progress along sound lines. The work done by the pioneers will reap its reward and with the production of more efficient types of machines and engines, there is no doubt but that aviation will play an increased part in the development and conservation of the recources of this Dominion.

"Mail and passenger services will follow more slowly as the present forms of transportation are efficient, highly developed and serve their purpose well. As an auxiliary to these services aircraft already play some part and a great opening exists here, especially in regard to summer tourist traffic. As the public gains confidence in flying, the demand for faster mails will become insistent and air mail passenger and express services will follow.

"The greatest need in aviation today is the creation of public confidence. This is essential to progress and, so long as it is lacking aviation cannot succeed. This cannot be gained by freak operations or stunts, however brilliant, but only by strict adherence to business principles and conservative operations on the part of aviation executives and careful flying on the part of pilots."

THE NEWS of THE MONTH

Convention Fifth District N. A. A.

The first convention of the Fifth District (Ohio, Indiana, Kentucky and Virginia) of the National Aeronautic Association of the United States was held at Cedar Point, Ohio, August 25 and 26.

Maj. Alfred W. Harris, Cleveland Chairman, welcomed the Detroit and Cleveland delegations who arrived from the air, also extended a welcome to all delegates. Seventeen cities were represented.

Hugh W. Robertson, Executive Committee, Detroit Aviation Society, gave details of arrangements for National Aero Congress and Pulitzer Races at Detroit, October 12-13-14. The Chairman replied pledging support of large delegation from Fifth District.

Lt. Col. H. E. Hartney, Executive Sec'y. National Aeronautic Association, Washington, D. C. spoke, praising liberal assistance shown by Mr. Howard E. Coffin, in particular, and others in general, in assisting his work.

Outlined official standing of Air Boards.

Gave instructions to delegates how to form their own air Boards on returning to their cities.

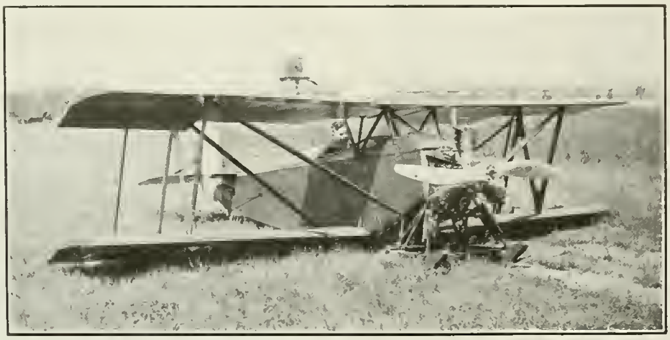
"Aeronautics cannot be a one man proposition—Air Boards solve all local questions for aviation".

Mentioned Squadron Re-Unions for national convention and also Field Reunions. Army and Navy and Lighter than Air reunions.

Arthur Halstead, Sec'y. Sectional Committee. Bureau of Standards, Washington, D. C., outlined the work which the Bureau and the Society of Automotive Engineers are doing in compiling the American Aeronautical Safety Code. This will form the nucleus for the Board of Aeronautics, when formed, to work with. A resolution later was passed, endorsing the work of this Department and the Secretary instructed to forward copies of same to the Bureau of Standards, and Society of Automotive Engineers.

Howard E. Coffin, of Detroit, Mich. spoke at length on the intensive study covering a number of years which he personally had given the subject of aviation. He emphasised the necessity of having a National Association from similar experiences in the automobile and Good Roads developments. Omitting the technical side of the question which he said would take care of itself, the two main factors in holding up the development of aeronautics to-day are: (a) Fear of riding in planes (coming from ignorance) (b) Lack of Legislation (federal, state and municipal).

He deplored the inactivity of Congress in passing laws already drafted, and predicted government subsidy or aid for the commercial airplane industry. He painted a word picture of future Pulitzer races, predicting eliminating trial meets in all sections of the country preliminary to the great flying classic, at which time the various district organizations could convene and elect their delegates to the National Aero Congress.



A Messenger Biplane Equipped with the New Sperry Landing Skids—Lawrence B. Sperry at the Wheel

William B. Stout, Designer and Manufacturer, Detroit, also addressed the meeting reciting some of the problems confronting the aeronautical interests today. He pledged active co-operation to the national body. He also stated that the Technical development was keeping place with the times.

Harvey Campbell, Secretary, Board of Commerce, Detroit, Mich. gave a brief outline of what the "Dynamic City" was preparing to do for the National Aero Congress and assured delegates that they would be well taken care of in Detroit. He stated that Detroiters were convinced that Aircraft is the next important industry and urged everyone to get in behind the movement for the N. A. A.

He deplored the adverse publicity methods of the press and suggested the addition to all crash stories (in black face type) "This is another example of the vital need of adequate Federal Legislation."

It was unanimously decided to postpone election of permanent officers, and ask the temporary officers to continue to carry on until the next meeting in Detroit, October 11th., the day preceding the National Convention.

During the session flying boats "Buckeye" and "Wolverine" of the Aeromarine Airways Company, flying boats of Messers. Long, of Lorain, and Audregg Bros. of Mansfield, Ohio, the "Great Lakes" cabin cruiser, of the Great Lakes Airways Company, Cleveland, Ohio, and "Waco" three passenger airplane of Weaver Air-Cedar Point during the conven-craft of Medina, Ohio, flew in to tion.

International Aero Show To Open in Paris Dec. 15

Arrangements have just been completed for an Eighth International Aeronautical Exposition to be held in Paris between Dec. 15, 1922 and Jan 2, 1923, in the Grand Palais des Champs-Elysees.

The classification of exhibits

hydroplanes, helicopters, gliders, provides for balloons, airplanes, motors, aerial navigation, metallurgy and construction materials with reference to aeronautical use, methods of manufacture, transportation and maintenance of aeronautical machines and apparatus, meteorology, aerial physiology, photography, cinematography, map making and bibliography.

Prospective exhibitors may obtain detailed information from the Commissioner General of the exposition, Andre Granet, No. 9 Rue de la Forge, Paris.

Co-operative Engine Test

The Post Office Department, the Navy and the Army have joined hands to make some endurance tests with airplane motors using high compression. The problem of compression in airplane engines, being intimately connected with cost of operation, power and altitude is one of great importance in airplane circles.

The Post Office Department has receiver word that the first of the high compression pistons lent by the Army and Navy Departments, have been installed in planes flying on the Cheyenne to Salt Lake City leg of the trans-continental air mail route. There where the altitude is 6,000 feet and planes often have to fly more than 9,000 to top the mountains, the rarified atmosphere lends itself to the use of high compression motors.

The equipment loaned by the Navy will have 6 to 1 ratio while the Army pistons are designed for 6.5 to 1 compression.

Ordinarily airplane engines use a five to one ratio of compression. At sea level with an atmospheric pressure of 14.7 these engines will function at rated horsepower. However, in the higher altitudes where the air pressure is lighter the compresson is necessarily less and the efficiency is cut considerably. Engines fitted with high compression for high altitudes knock at low altitures. The Army and the Navy have long been experimenting to overcome the difficulty in order to increase the power of their machine in high flying. One of the developments has been an anti-knock fuel. The Army and the Navy, however, have no opportunity for sustained tests as in the case with the Air Mail Service. Moreover the high elevation of parts of the western route are better suited to high compression engines. For this reason, the tests will be made to determine if an increase in speed and carrying power can be secured and if the engines will function well under such compression.

Aero Club of Pennsylvania

The stated monthly meetings of the Club for the coming season will commence with the September meeting which will be held at the Engineers' Club, 1317 Spruce Street, Friday Evening, September 15th, at 8 o'clock sharp.

To all of our members it will come as sad news that our beloved Secretary, Dr. George S. Gassner, died August 25th. As one of, if not the oldest member of our Club, he has been the most active and hardest worker of our organization; a founder member and the one remaining tie to the early history of the Club. It is the expression of our entire membership that his loss will be keenly felt by our Aero Club and his host of friends who held him in such high esteem.

It is hoped that every member of the Club will make a special effort to attend this opening meeting and discuss freely plans and ideas for the coming season. It is planned that in the future, monthly meetings will be regularly held and that renewed interest and increased membership will result therefrom. The program Committee is planning to map out a most interesting course of lectures on aeronautics by proship gradually but those who have minent engineers, builders and well known pilots. If sufficient interest can be aroused, a model contest will be held early in October. It is also planned to arrange to hold a Field Day Meeting at an early date at the Pine Valley Flying Field—prizes of free aerial rides will be offered new members and a special rate will be extended to all Club members who desire to take a flight.

New interest in aeronautics is being shown throughout the country and increasing activity indicates a slow but steady growth of the business. The reports of the great commercial air lines conducted in this and foreign countries and of the U. S. Air Mail Service, of millions of miles flown during the past year without accident, shows conclusively that air travel on these lines is practically safe, if not even safer, than any other mode of travel; with almost equal comfort and in half to a quarter of the time.

Let us turn out in full force and have a well attended meeting, discuss our plans for the future, talk over with the Program Committee plans to interest and bring out the members. It is not too early to discuss who we want for officers for the coming year and many of the older officers feel that they should be retired to the Board of Directors and that the new members be put in charge. Our Club is in a good healthy financial condition and increasing in memberheld office for many years believe that those who have lately joined our ranks are entitled to the honor of holding office and building up the Club.

JOSEPH A. STEINMETZ
President

The Ballancer C F-5 described on page 503

THE AIRCRAFT TRADE REVIEW

Aeronautical Chamber of Commerce Elects Officers

AT the annual meeting of the nautical Chamber of Com- Board of Governors, Aero- erce of America, 501 Fifth Avenue, the following officers were elected: President, Inglis M. Uppercu, Aeromarine Plane & Motor Co., Keyport N. J.; First Vice-President, Charles L. Lawrance, Lawrance Aero-Engine Corp., New York City; Second Vice-President, C. C. Witmer, Airship Manufacturing Company of America, Hammondsport, New York; Third Vice-President, Lawrance B. Sperry, Lawrence Sperry Aircraft Co., Farmingdale, L. I.; Treasurer, Charles H. Colvin, Pioneer Instrument Company, Brooklyn N. Y.; General Manager and Assistant Treasurer, S. S. Bradley; Secretary, Luther K. Bell; Assistant Secretary, Owen A. Shannon.

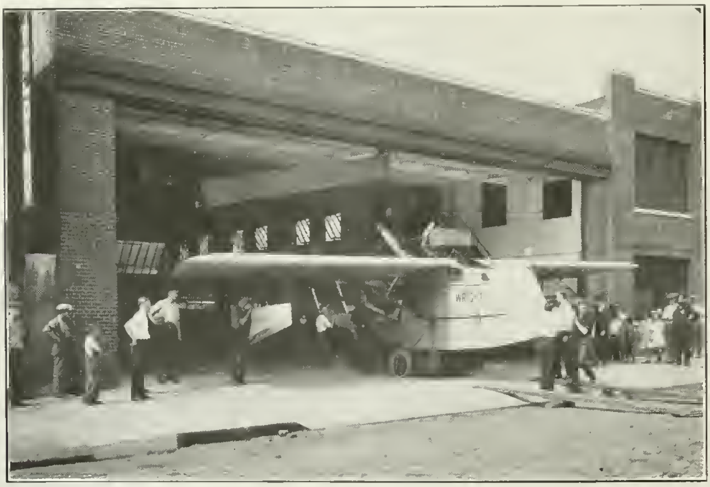
Increases in the Board of Governors from eleven to fifteen were made as follows: I. M. Uppercu; G. M. Williams, General Manager, Dayton Wright Company, Dayton, Ohio; W. C. Young, Goodyear Tire & Rubber Company, Akron, Ohio; Charles L. Lawrance.

Steady growth by the Aeronautical Chamber of Commerce was reported; recent additions to the membership including Goodrich Rubber Co., Akron, Ohio; Goodyear Tire & Rubber Co., Akron, Ohio; Wolverine Lubricants Co. of New York, New York; Rich Tool Co., Chicago, Ill.; Mosler Metal Products Corp., Mt. Vernon N. Y.

Baldwin Aircraft Corporation

The Baldwin Aircraft Corporation recently obtained possession of the well equipped plant and other manufacturing facilities of the Ordnance Engineering Corporation and is now in a position to execute orders for aircraft, aircraft parts and for any class of machine shop, sheet metal and wood work. Its plant is located in the center of an established aircraft community about one hundred feet from the Baldwin Station on the Montauk Division of the Long Island R. R. and may be reached in forty-five minutes from New York City. In addition to having an ideal railroad location the plant is at the junction of two highways and about midway between Mineola and Far Rockaway, consequently both land and water machines can be conveniently received and delivered by air.

Mr. William F. Bennett, formerly Secretary and Treasurer of the Lewis and Vought Corporation, is President of the Baldwin Aircraft Corporation and Mr. John J. Rooney, recently Engineer and Production Manager of the Chance Vought Corporation, is General Manager.



The Loening Air Yacht for the Wright Aeronautical Corporation. The illustration also shows the Engine Doorway to the Loening Factory, which enables shipment without taking down the Machines

A New Curtiss Aviation School

During the last two years the Curtiss Company has felt a growing demand for a flying school which would not only teach a man to solo, but would give him a chance to acquire enough time after his preliminary training to give him experience. It is a recognized fact that a young man of average ability and intelligence, in proper physical condition, can learn to fly sufficiently well to handle a machine in safety in a period of six to ten hours of flying instruction, and it is this instruction that commercial schools have been able to give. However, to send a pilot on a commercial job with this amount of training is suicidal, and no commercial company would consider employing him. Consequently, there has been little incentive for a young man to attend a flying school under these conditions (if he knew them) and the problem has been to supply this fifty hours of flying in which a student can acquire the experience necessary to make him a capable pilot without too great expense. To date no school has been able to do this, and few students are able to afford the three thousand dollars that such training would cost.

With this in mind, the Curtiss Aeroplane and Motor Corporation has arranged, through the Curtiss Exhibition Company, to operate its Aviation School at Garden City, L. I., offering the following inducements to students with the idea of solving the above problem:

A flying course in ten hours.

Eight weeks intensive training in aeroplane mechanics and its auxiliary subjects.

A complete Radio course.

Presentation to graduates of a JN aeroplane equipped to take OX motor, less motor.

The cost of the complete course, including flying training and the aeroplane, will be five hundred dolmotors are available throughout the country at reasonable prices, so that at a minimum cost a student can get his preliminary training, together with an aeroplane, on which he can acquire the experience mentioned above, at the cost of his gas and oil, and become a pilot capable of demanding a good position. In fact, after a little practice, he will be able to use his machine for passenger carrying, advertising, etc., with a good chance of fair profit together with his training.

A part of the work in the school will be the reconditioning of the machine and overhauling of motors by the students themselves under competent supervision. This will familiarize them with their own machines and give them practical training that no other method could give.

Furthermore, classes will be given to a limited number in aeroplane and motor work alone, at a cost of one hundred dollars, and those attaining the required standards will be placed in the Curtiss Organization. Plans are under way for a Club where the students can get room and board at minimum rates.

The Curtiss Company believe that this scheme will fill a long felt want and will go a long way towards popularizing and commercializing aviation.

Woman Buys First Aerial Commutation Ticket

The unique distinction of being the first woman to purchase an aerial flight commutation ticket has fallen to Miss S. D. Winter, sales manager of the Motor List Company of Cleveland.

Miss Winter's main office is in Detroit and she has occasion to go over to the Michigan City two or three times a week. Several days ago friends persuaded her to try the aerial route and she flew over in the "Wolverine," eleven passenger flying boat; one of a fleet now being operated by the Aeromarine Airways on a daily schedule between this city and Detroit. Upon the completion of her first aerial voyage, Miss Winter asked the passenger agent of the company if she could purchase a commutation ticket at a special rate. The regular fare for the round trip is $75. The passenger agent recently issued her a ticket at the Aeromarine Booking Office in the main lobby of the Hollenden Hotel. This ticket calls for 14 round trip flights at the special rate of $50 per round trip.

When asked why she had chosen the air route Miss Winter said:

"Time is a great element in my business. It did not take me long to realize that I could save practically one day and two nights by flying over to Detroit and returning the same day. And there is another angle to it too—I tell my prospect that I just flew in to get his order and I generally get it."

The double daily flying boat service between Cleveland and Detroit is being well patronized by the citizens of both Lake cities.

WRIGHT E-2 ENGINE TEST

As a result of a recent test conducted on an E-2 Wright engine, the Navy Department announced the possibilities of a marked increase in the power and dependability of aeronautical engines designed for use in scouting-type planes.

The test was held at the Anacostia Naval Air Station. The engine ran through 250 hours with the throttle open. The demonstration, it was said, may pave the way for all aviation engines not only to pass through long periods of running but to do so with their full rated power.

The department considers the feat of great importance in lengthening the range of scout planes and increasing their dependability to make an extended reconnoissance and return to their battleship base. The planes which are catapulted from the decks of battleships are equipped with the Wright engines.

M. A. A. Elects Officers

At the Annual Meeting of the Manufacturers Aircraft Association, Inc., the following directors were elected; A. H. Flint, L. W. F. Engineering Co., College Point, L. I.; F. L. Morse, Thomas-Morse Aircraft Corporation, Ithica, N. Y.; F. B. Rentschler, Wright Aeronautical Corporation, Paterson, N. J.; J. K. Robinson, Jr., Gallaudet Aircraft Corporation , East Greenwich, R. I.; F. H. Russell, Curtiss Aeroplane & Motor Corporation, Garden City, L. I.; I. M. Uppercu, Aeromarine Plane & Motor Company, Keyport, N. J.; J. G. Vincent, Packard Motor Car Company, Detroit, Michigan; C. M. Vought, Lewis & Vought Corporation, Long Island City, L. I.; G. M. Williams, Dayton Wright Company, Dayton, Ohio.

Officers were elected as follows: President, G. M. Williams; Vice-President, F. B. Rentschler; Secretary, Chance M. Vought; Treasurer, F. H. Russell; General Manager and Assistant Treasurer, Samuel S. Bradley.

Remarkable Piston Ring Sales

The fact that The Piston Ring Company of Muskegon, Michigan has only been going after replacement business for less than a year, attaches special significance to the recent production record of 5,232,031 QUALITY Piston Rings during two consecutive working months. Although the Piston Ring plant is the largest exclusive piston ring factory in the world with its capacity of 12,000 rings per working hour, there is every reason to believe that further expansion will soon be necessary to keep abreast of the ever-increasing demand for QUALITY Piston Rings.

500 Civilians Learning How to Fly

According to reports compiled by the Aeronautical Chamber of Commerce, approximately five hundred persons are being taught to fly at the score or more of flying schools located in various parts of the United States. Among the leaders in civilian flying instruction are New York, Chicago, Dayton, Ohio, San Francisco, and points in Missouri, Oklahoma, and Texas. Most significant returns are found in Dayton, Ohio, "The birthplace of the airplane", where at the field of the Dayton Wright Company, 4000 inquiries have been received this summer from civilians who are desirous of learning the requirements and cost of instruction in flight.

No Chicago Meet This Year

Under the date of August 26th the Chicago Aeronautical Bureau advises Aerial Age as follows:

"We regret to be compelled to advise you that causes beyond our control have made it necessary to postpone until next year the Air Program originally scheduled to be held in Chicago from August 4th to 13th, inclusive, under the auspices of the Chicago Aeronautical Bureau.

"Believing you will be interested in knowing the reasons for this postponement we wish to explain that formal permit has been issued by the South Park Commissioners for the use of Grant Park on the

Grant Park which had temporarily been held in abeyance for us could not be longer delayed, and this work made it impossible for a considerable time to use the space set aside for a landing field.

"As we consider Grant Park the only place in or near Chicago where such a Meet could be successfully held, we were reluctantly compelled to abandon our plans until next year. The Chicago Aeronautical Bureau will commence preparations in February, 1923, for the holding of its Air Pageant during the first two weeks in August. With plenty of time and money at our disposal we expect to make it the greatest affair of its kind ever held. It will include not only a large number of flying events with liberal cash prizes, for the various classes of planes, but also an exhibition of aircraft and aircraft parts and material, as well as an Aeronautical Congress with addresses by the country's foremost authorities on the various phases of aeronautics.

"In the meantime the Chicago Aeronautical Bureau (incorporated not for profit) will actively continue its work in educating the public to the commercial possibilities of aircraft and in advancing Chicago's aeronautical interests in every way.

"We wish to thank you for the interest you have shown in the plans for our Air Program, and will advise you fully as soon as the dates are definitely fixed for next year, when we hope to have you with us."

Frostburg Landing Field

The city of Frostburg, Md., has established and improved, at considerable labor and expense, a landing field about 2½ miles southeastward of that city. The improved part of the field as it now stands is 1,200 feet long by 1,000 feet wide, having sufficiently clear approaches to make it available for most of the present type planes.

The field is marked by a circle, 100 feet in diameter, with a band 3 feet wide, painted white. This marker indicates the center of the best landing area. A wind cone has been erected to indicate the direction of the wind.

The location of this field at Frostburg, in the center of a country where landing fields are few, is an important addition to the model airway, located as it is midway between Washington, D. C., and Moundsville, W. Va.

Approximate position, latitude 39° 40′ N., longitude 78° 65′ W.

FLY
CLEVELAND
DETROIT
DAILY
90 Minutes
Aeromarine Airways Inc. - Great Lakes Division

The booking office of the Aeromarine Airways in the Main Lobby of the Hollender Hotel, Cleveland.

Oxygen Instruments

This report (No. 130), by F. L. Hunt, of the National Advisory Committee for Aeronautics, contains an introductory discussion of the physiological effects of the lack of oxygen at high altitudes and the amounts required to be supplied artificially to aviators under normal conditions of flight. It discussed in detail the various types of aircraft oxygen apparatus which have been designed and used not only in this country, but also in England, France, and Germany. Instruments of both the compressed oxygen and liquid oxygen type are considered.

Methods of testing oxygen apparatus used at the Bureau of Standards are also fully described and the quantitative results of tests of sample instruments of different types are given.

A copy of Report No. 130 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D.C.

The Pressure Distribution Over the Horizontal Tail Surfaces of an Aeroplane, III

Report No. 148 by F. H. Norton and W. G. Brown, of the National Advisory Committee for Aeronautics deals with the distribution of pressure during accelerated flight of the full-sized aeroplane, for the purpose of determining the magnitude of the tail and fuselage stresses in stunting.

As the pressures to be measured in accelerated flight change in value with great rapidity, it was found that the liquid manometer used in the first part of this investigation would not be at all suitable under these conditions; so it was necessary to design and construct a new manometer containing a large number of recording diaphragm gauges for these measurements. Sixty openings on the tail surfaces were connected to this manometer and continuous records of pressures for each pair of holes were taken during various maneuvers. There were also recorded, simultaneously with the pressures, the normal acceleration at the center of gravity and the angular position of all the controls.

The present investigation consisted in measuring on a standard rigged JN4H aeroplane the distribution of pressure over the whole of the horizontal tail surfaces while the aeroplane was being put through maneuvers as violently as it was thought safe, including spinning and pulling out of dives.

A copy of Report No. 148 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

ARMY and NAVY AERONAUTICS

Marine Corps Demonstrates.

A demonstration of the work of the 4th Air Squadron, U. S. Marine Corps, before a distinguished party of guests was held at Bowen Field, Port-au-Prince, Republic Haiti, during the early part of August, and illustrated the important part that aviation has come to play in the work of policing the troubled parts of the Carribean.

The party in honor of whom the exhibition was given included The U. S. High Commissioner to Haiti, the President of Haiti, and his cabinet, the Chief Justice, the Chief of the Gendarmerie D'Haiti, the Chief of the Engineers and the Sanitary Service and the Mayor of Port-au-Prince.

The program included a formation flight of D H 4 B's, a demonstration of the use of the ambulance plane attached to the squadron, radio communication with plane in the air, practice bombing and gunnery flights, parachute jumping, and an exhibition of stunting and a "dog fight" between two J N planes.

The exhibition was staged in the presence of an audience of two thousand persons.

The unsung praises of the Marine Aviation unit's in Haiti and San Domingo does not affect the fact that this important branch of the service has done and is doing an important work in the far flung reaches of the tropical jungle toward the establishment of peace and good order.

The airplane patrol established over the island republics has been the means of seeking out and checking incipient revolutionary movements in numberless instances in a manner that would have been well nigh impossible through the use of scouting units of infantry. As a means of communication between widely separated posts throughout the island the aviation have proved invaluable. And in addition to the military uses of the airplane the ambulance service established by air through the use of a specially equipped ambulance plane has brought to the service of outlying posts the last word in speedy medical assistance and has been the means of saving lives not only of members of the expeditionary forces but of any and all who might have need of medical assistance.

Conclusion of R.O.T.C. Students' Camp at Mitchel Field.

Twenty-three R. O. T. C. students from the Massachusetts Institute of Technology, who have been in camp at Mitchel Field for the past six weeks, departed from that station on July 26th. Major J. C. McDonnell and Captain Wm. B. Wright, Air Service, who were in duty at this station in connection with this camp and who have been for the past year instructors in the R. O. T. C. Unit of the above institute, remained at Mitchel Field to assist in the training camp for Reserve Officers which was already in progress at the conclusion of the R. O. T. C. Camp.

New Altitude Record in Bombing Machine.

Ascending to an altitude of 23,350 feet in a Martin Bomber, Lieut. Leigh Wade, test pilot at McCook field, Dayton, Ohio, broke his own altitude record made several months

An interesting Group at the Gordon Bennett Balloon Race at Geneva ago for an airplane carrying three passengers. Lieut. Wade performed his latest feat on August 1st., and he was accompanied by Captain A. W. Stevens, aerial photographer, and Sergeant Roy Laugham, observer. The bomber was equipped with a Moss supercharger.

Contrary to most altitude trips, this flight was without any unusual incident. The temperature was slightly below zero, while a wind, estimated at 100 miles an hour, was recorded. The flight took 2 hours and 15 minutes. One hour and 52 minutes elapsed before the ship reached the ceiling, while only 23 minutes were required for the return trip.

Lieut. Wade believed that with several minor adjustments he can climb the Bomber to a higher altitude.

Aerial Observation School Makes Fine Record.

The most thorough course in flying ever given to any Air Service class terminated at the School for Aerial Observers, Post Field, Fort Sill, Oklahoma, on June 30, 1922.

The course opened January 16, 1922, with 3 Captains, 11 First Lieutenants, one cadet from the Regular Army and one foreign officer, Lieut. Shen from the Chinese Navy. The only changes in personnel during the course were as follows: On February 14th, Cadet Wright crashed and was killed; on March 15th Lieut. Zuniga Cooper, of the Chilean Army, was transferred to the Observation School from the Communications School; and on April 12th Lieut. R. L. Williamson was assigned to the School from Carlstrom Field. On June 30th the School graduated 15 regular officers and two foreign officers.

The subjects covered in the course were Liberty Engines, Rigging, Artillery, Contact, Photography, Visual Reconnaissance, Radio, Army Regulations, Infantry Contact, Minor Tactics, Rules of Land Warfare, Gunnery and Flying. The technical part of the course was given in the Rigging and Motor Shops, and the theoretical part in the class rooms.

The remarkable thing about the course was that, in spite of the great number of flying hours, there was only one fatal accident, and that occurred in the early stages of transition work.

Night Flights of the AirshipC-2.

The night flights recently made by the Airship C-2, one from Aberdeen, Md. to Philadelphia, Pa., and return, and the other from Bolling Field, Anacostia, D. C., to New York City, and return to Aberdeen, served as an ample demonstration of the ability of airships of this type to successfully negotiate long distance flights despite unfavorable weather conditions, and that they can be navigated sufficiently close to the ground to pick up lights and land marks under such conditions, even when confronted by fog and rain, with relative safety to the passengers on board and to people on the ground.

The first trip, the purpose of which was to make a night practice flight in order to give the crew some good experience in handling the ship at night preparatory to the trip to New York City, and at the same time to test the new type of bomb rack which is being installed on the ship, was started from Aberdeen Proving Grounds at 6:00 p.m. The crew on board consisted of Major James A. Mars, Captain W. E. Kepner, 1st Lieut. E. S. Moon, Lieut. R. J. Parker, R. O. T. C. and Sergeant A. D. Albrecht. The bombing was conducted from an altitude of 2,000 feet, dummy bombs being used, one weighing 300 lbs. and the others 100 lbs. The bomb rack functioned satisfactorily.

Upon concluding the bombing practice, the ship proceeded on a cross country flight to the Delaware River, and thence up this river to the vicinity of Philadelphia, Pa. It returned via. the same route and arrived at Aberdeen shortly after 11 p.m.

In the early evening and for some time after dark, land marks were easily discernable, but around nine o'clock a thick fog was encountered. The wind was quite dusty and rain fell at intervals. At times land marks were very hard to distinguish, and only a few lights were visible. It was necessary to steer entirely by compass, but the course was held very accurately. The radio apparatus on board functioned splendidly, and communication with the Aberdeen Proving Grounds was maintained practically during the entire time of the flight.

The appearance of the ship at night over the various cities and towns en route apparently created considerable excitement, as evidenced by the flashing of small searchlights and the burning of some flares at various times, evidently for the purpose of attracting the attention of the aeronauts. The trip was made in a northeast wind, which was blowing at the rate of about 15 miles an hour, at times rising to a higher intensity, the average altitude maintained being between 1,000 and 1,200 feet.

In commenting on the trip, Major Mars stated that altogether it was a very enjoyable and instructive practice flight, and he sees no reason why a ship of the C-2 type should not operate very successfully at night under average conditions.

On the following day, the C-2 took off from Bolling Field at 4:30 p.m. and arrived in New York City at 11:30 p.m., standard time. Very good visibility was had while over Philadelphia, and the ship flew over the Quaker City about 20minutes. After passing Trenton, N. J., heavy fogs and rain were encountered. Flying across the mouth of upper New York Bay at about 600 feet altitude, the lights of the bay could not be seen, and it was not until Coney Island was reached that any lights were picked up. The ship next flew over New York City at an altitude of 500 feet, but again fogs were encountered and the lights of the city could not be seen. It hovered over the city for about one and one half hours, being alternately in and out of the fog, and while circling the Statue of Liberty it was picked up by the searchlights at this point.

The radio apparatus on board functioned until Trenton was reached, so that while the C-2 was over in New York City no radio communication was possible.

The return to Aberdeen was made without incident and the ship landed at 5:30 a.m. July 28th.

An Aviation Beacon

A representative of the Lawrence Sperry Aircraft Corporation recently visited McCook Field, Dayton, Ohio, for the purpose of demonstrating in connection with night flying a new truck and searchlight combination known as the Sperry Duplex Truck. The purpose of this light is to serve as a beacon to mark landing fields for night-flying airplanes. The light. which is of high intensity (three hundred million candle power), with a reflector measuring 36 inches in diameter, is the same type as that used on battleships at sea, but this is its first adoption for land purposes. By its radiation a landing field should be located from 75 to 100 miles away. The engine of the truck performs double duty, serving as power for the truck when in motion and for the searchlight when the truck is still.

REVIEW of WORLD AERONAUTICS

A Million Kilometers Without Accident.

One million kilometers (621,370 miles) of flying with passengers, freight and mail were completed by the Royal Netherlands Aeroplane Company on July 22, 1922, says consul Mahin, Amsterdam, in advices to the Department of Commerce.

Not a single accident has occured, the consul reports. This company has a daily service between Amsterdam and Paris and a twice a day service between Amsterdam and London. The distance over each of these routes is approximately 300 miles.

Cross Channel Traffic.

The returns of air traffic on the cross-Channel routes to Paris, Brussels and Amsterdam, during the three months April-June, are now available from the Air Ministry.

During this quarter 764 machines departed from the London Terminal Aerodrome, Croydon, and 768 machines arrived, the total number using the aerodrome on Continental services being 1,532. This is a considerable increase on the figures for the same period last year, when 506 machines departed and 495 arrived.

The majority of machines were of British nationality, belonging to the Handley Page Transport, Ltd., the Instone Air Line, and Daimler Hire, Ltd. The figures by nationality are:—British, 915; French, 228; and Dutch, 189. Last year British machines numbered only 246 out of a total of 1,001 machines using the aerodrome.

The total number of passengers carried during the period was 3,128, and is a slight decline on the total of 3,565 carried a year ago. The proportion carried by British companies has, however, greatly increased, 2,402 travelling in British machines against 1,653 in the same period last year. British traffic therefore amounted to 76.8 per cent. of the total, whereas last year it was only 46.4 per cent.

The total weight of goods carried by aircraft to and from Croydon was 144 tons, which is a large increase on last year, when the figure was 56.9 tons. Half of this total was carried by French machines, but the British share of the traffic shows the largest proportionate increase, 53.6 tons having been transported by British machines against 4.9 tons a year ago.

The efficiency of British air service continues to be of a high standard. In April the efficiency of flights made and completed within four hours by British machines on the London-Paris route was 92.3 per cent. For May the figure was the same, and for June it rose to 95.2 per cent. The figures for French machines during the same period on the same basis were:—April, 71.3 per cent.; May, 85 per cent.; and June, 79.1 per cent.

Not withstanding these figures it has to be noted, however, as stated in the last half-yearly report on Civil Aviation, that a considerable increase in traffic is essential if Air Transport firms are to obtain a commercial basis of operation, the passenger accommodation occupied on British machines being only 37 per cent. in April, 30 per cent. in May, and 31 per cent. in June, and the useful cargo capacity used only 44 per cent. in April, 44 per cent. in May, and 40 per cent. in June.

Italian Airplanes and Airships in Brazil.

The Minister of War, Hon. Soleri, has decided to send a series of the most modern airplanes and hydroplanes to the International Exposition of Rio de Janeiro.

He has also decided to send several types of small airships, that have been experimented with success, during the last stages of the war and after the Armistice.

The planes will be furnished by the Army and will be piloted by Aviators of the Air Service.

The Hon. Soleri has forwarded a circular to all the Italian Constructors of Airplanes and Airships inviting them to send the most modern types of planes to the Capital of Brazil, in order to uphold the prestige of Italian Aviation.

Napier Performance.

The Napier-engined D.H. 34 machines at present used by the Daimler Airway Company carry out a double return journey between London and Paris each day, and during the month of June for the first time in one week this double return journey was made each day for five days by the same engine and machine, and it says much for the reliability of the 450 h.p. Napier engine that at the end of the week—after having completed 4,600 miles in that week—it was running as smoothly and efficiently as ever.—London Financial TIMES.

France—Spain Postal Service.

It is announced that the Spanish Government has given its consent to the inauguration of an aerial postal service between France and Spain. An agreement is being drawn up between the Spanish Government and the Latecoere Company, which will undertake the transport of mails to and from Spain by utilizing the airplanes already plying on the Toulouse-Casablanca route, which land at Barcelona, Alicante and Malaga. It is also likely that an agreement will be made with regard to the transport of goods by air between France and Spain.

Danish Progress

The Danish Airship Co., having obtained official guaranty for one-half of a possible deficit, is arranging express traffic connections with Central Europe. The company is to take certain mail in exchange for the Government's promise of assistance.

The daily service to Hamburg can take 300 kilos of freight or three passengers, but the route is established only with the idea of taking freight and mail. Germany will furnish three and Denmark three of the machines used on the Copenhagen-

International Air Traffic Association in Convention at Copenhagen, Denmark

Hamburg line. The Danish planes are rebuilt and improved DeHavilands.

Another air route, embracing Essen, Brussels, London and Paris, is expected to be opened the 1st of July.

Bristol Performance.

Remarkable results have been achieved in Paris during the tests of an English aero engine by the French Air Ministry. The engine is the 400 h.p. "Bristol" Jupiter radial air-cooled engine, and the performance and reliability shown has never been equalled in France. For five periods of non-stop runs, during which, according to the French official report "the engine behaved itself perfectly and there were no replacements of any sort". For half an hour at the beginning of each period the engine was run at full power—in each case over 400 HP and at nine-tenths full power for the remainder of the period.

These results are the more remarkable when one reflects that if the engine were fitted to an aeroplane, each non-stop period represents over 1,000 miles of travel.

Some few months ago it was recorded that the Jupiter engine had passed the 50 hours endurance tests laid down by the British Air Ministry—the first air-cooled engine to do so.

The French, always keen judges of purposes the tests mentioned were called interested and soon afterwards it was announced that the largest aero engine makers in France, the Gnome & Rhone Company, had obtained the constructional rights for France and neighbouring countries.

Before acceptance for French official purposes the tests mentioned were called for. To the official report is added the remark that the 50 hour period of test might have been doubled so far as the engine is concerned.

These results have been achieved by the makers, the Bristol Aeroplane Co. Ltd. after nearly four years of unflagging research and experiment. The fact that they have now evolved an engine of 400 h.p. weighing only about 1¾ lbs. per h.p. and of unequalled reliability marks an epoch in aviation. The engine is already used in certain of the aircraft seen by the public at the Aerial Pageant and this number will doubtless be increased. Commercial machines with this power unit are also in construction.

British aero engines have deservedly gained a reputation as the finest in the world and the success of the Jupiter engine in France adds yet another link to the chain.

A Siddeley Success.

The Armstrong-Siddeley 325 h.p. radial air-cooled engine known as the Jaguar has just very successfully completed its official Type Test under Air Ministry observation. This particular test was made under the new regulations which call for the whole of the 50 hours' test being made in 10 hour non-stop runs and the Jaguar is the first air-cooled engine—if not the first engine of any type—to pass the British tests under this rule.

The performance on test was most satisfactory, and both fuel and oil consumption were extremely good. Full details of the test and a description of the engine will be given in the immediate future.

Aeronautical Map of Italy

The Secretary of State, recognizing the need of an aeronautical map of the Kingdom, that would offer informations and exact references to aerial navigators; considering that only a public contest would give the best results; hearing the opinion of the Council of State; decides:

Art. 1-To ban a competition for the edition of an aeronautical map of Italy. The conditions are fixed on this brief. All the Italian citizens can participate to the contest.

The following prizes have been assigned to the contest:

1st. prize-Lire 20,000
2nd prize-Lire 10.000
3rd prize-Lire 5,000

Art. 2-The contestants will have to present the original or the lithographic production of the sheet of the future aeronautical map of Italy and precisely the one comprised between 8° and 9° of longitude East Greenwich. 45° and 46° of northern latitude. Said sheet should be countermarked with a motto and addressed to the Ministry of War Superior Command of Aeronautics: Civil Service Section with a sealed envelope bearing the same motto, enclosing a card with the name, surname, paternity, address of the contestant and again the distinctive motto.

Art. 3-The time for presenting the work expires October 31st, 1922. All the works delivered after such date will be returned.

Art. 4-The examination jury will consist of: the Director of the Geographical Military Institute, of a delegate of the Hydrographic Institute of the Royal Navy, a representative of the Aeronautical Inspectorate of the Royal Navy and an authorized member of the National Sport Associations.

Art. 5-The works which will be awarded prizes will become the exclusive property of the Military Administration, who will use them for the edition of the aeronautical map of Italy, making if necessary, changes and additions so that the map will answer better the purpose destined to. The other works will be returned to the owners.

Caproni Metal Plane.

The Caproni firm announces that they have completed a new type of an all metal aeroplane.

This news has met with great favor in the Italian aeronautical circles.

It is said that the public experiments with the new Caproni will be made soon.

Germany's Reply to Restrictions

From Berlin it is reported that the German Government has sent a note to Denmark, Norway, Sweden, Holland and Switzerland informing the respective governments that only aeroplanes conforming with the restrictions placed upon German aircraft will be permitted to cross the German frontier. This is a clever move on the part of the German Government, and obviously intended to reduce the handicap which the restrictions of the Allies places upon German civil flying. If any of these countries wish to run services into Germany they can now only do so by using machines of as low power and fuel capacity as those to which the Germans themselves are restricted.

500-Aeroplane Fleet Planned by Britain

With no limitation of air armaments in sight, Great Britain now plans to build a fleet of 500 aeroplanes for home defense Critics of the extension of the air fleet regard it as putting a premium on air armaments.

Premier Lloyd George announced this big building program in the House of Commons, saying the decision to do so resulted from an inquiry by the Committee on Defense of the Empire. At the present time Britain has thirty-one squadrons, only twelve of which are in the British Isles France, however, will have at the end of next year fully 220 squadrons, besides several hundred machines which can be drawn from civil aviation in the event of an emergency. It will cost nearly $10,000,000 annually to maintain the new British home defense air force.

The Premier indicated that if necessary there would be a further extension of the air service. It is understood orders for aero engines will be divided among five firms.

Aerial Mail from Germany to Russia

The aerial mail service initiated on May 6 from Hamburg via Stettin to Danzig, Konigsberg, Kovno, Riga, and Moscow, has made a marked reduction in the time required for delivery of mails between Germany and Russia, according to recent dispatches from Consul Huddle, Hamburg. The saving amounts to 24 hours in mail for delivery to Kovno, and 36 hours for mails to Riga. In addition there is a saving of 5 hours time in the Danzig and Konigsberg mails.

A daily service from Hamburg to Kovno is maintained, and from Kovno to Riga the trips of the mail planes are on Tuesdays, Thursdays, and Saturdays. From Konigsberg the planes leave on Thursdays and Sundays to Moscow, the flying time to Moscow being in the neighborhood of 37 hours.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

THE "COOK 42" HYDRO

THE "Cook 42," designed by Ellis C. Cook, second prize winner in the National Model Aeroplane Competition for hydros and duration record holder for twin-screw hydros, is constructed along orthodox lines. Although designed in the winter of 1914-1915 it was not completed until just prior to the hydro competition. It is of the common "A" frame design with the 1-1-0 P2 wing and propeller arrangement. The float system is of the familiar 0-2-1 system. The model is fairly light, weighing, when complete, 3.33 ounces, of which 1.2 ounce is rubber motor.

Frame and Chassis

The frame is built up of two white pine strips 38¾" long and 5/16" x ⅛" in cross section. They taper towards the ends where they are only ⅛" and 3/16" high in the front and rear respectively. The strips are braced by three "X's" made of 3/16" x 3/64", streamlined. These prevent any bending tendencies in a sideward direction.

The propeller bearings are small streamlined forgings of light weight. They are bound to the frame with thread and coated with a celluloid solution. The front hook is made of No. 16 piano wire bound to the frame.

The chassis holding the floats is made of 3/32" bamboo bent to shape and bound to the frame. The floats are attached to the chassis by rubber bands, the angle of the front floats being adjustable.

Wings

The main wing has a span of 36" and a chord of 5". It is constructed of two white pine beams 30" long with bamboo wing tips. The ribs, seven in number, are also of bamboo and are spaced 4½" apart. The elevator, or front plane, has a span of 14" and a chord of 3½".

The framework of this wing is entirely bamboo. The entering edge is given a slightly greater dihedral than the rear edge, so that the angle of incidence at the center is slightly less than it is at the tips. In this manner the added incidence in the front plane is obtained. Both wings are fastened to the frame with rubber bands.

Floats

The two front floats are spaced 8" apart and are of the stepped type. The step is 3½" from the front and is ⅛" deep. The two front floats are separated by two bamboo strips tied to the rounded portion of the under-carriage by small rubber bands. By sliding these strips back and forth, the angle of the floats may be altered to suit conditions.

The floats are built up of two pieces of very thin pine for sides, separated by small pieces of wood about half the size of a match in cross section. The floats and wings are covered with chiffon veiling waterproofed with a special preparation. This makes a watertight and strong construction without any undue weight.

Power Plant

The two ten-inch propellers with which the model is equipped have a theoretically twelve-and-one-half-inch pitch. They are carved from blanks ½" thick and have blades with a maximum width of 1" at a radius of 3". The shafts are made of No. 16 piano wire, and have small washers for bearings.

Each propeller is driven by three strands of ¼" rubber. The rubber is given about 1,700 winds, and turns the propellers at 1150-1200 R. P. M. when in flight. When not in flight the R. P. M. is considerably less, or about 750.

When in flight the model seems to be somewhat overpowered, although this is not the case. It takes but two or three feet of run to leave the water, and climbs at a very steep angle to an altitude of about 125 feet. The motors unwind in 85-90 seconds, the glide making up the rest of the flight. From a duration standpoint its flights have been very consistent out of six timed flights, four have been between 98 and 100.6 seconds, which is somewhat unusual for a model which makes good duration.

Characteristics and data relating to some of the successful models of Illinois Model Aero Club members:

	Name of Designer and Type of Machine			
	Cook Hydro	Hittle Hydro	Schweitzer Duration	Pease Durat on
Wing area (sq. ft.)	1.39	1.5	.92	.92
Total weight (ozs.)	3.33	1.75	1.96	1.61
Wing loading (wgt./area)	2.4	1.17	2.13	1.75
Duration of flight (secs.)	100	116	230.8	207
Weight of rubber (ozs.)	1.2	.6	.88	.68
Resistance factor	4.5	8.75	7	6.3
Thrust, each propeller (lbs.)	.37	.2	.14	.12
Propeller disk area (sq. inches)	137	78.5	266	226
Air pitch speed (ft. per sec.)	20	14.8	......	10
Effective pitch (per cent)	63	59	......	59
Revolutions of propeller	1700	1500	......	......
Lgth. of rubber (feet)	3.33	3.1	3	3
Propeller diam. (inches)	10	10	13	12

Reader of Aerial Age in South America Buliding Novel Gliding Machine.

From Uruguay, South America, a report has reached Aerial Age describing a gliding or soaring plane being constructed by Hector Symonds, a novel feature of this glider which is nearing completion, is the employment of a small engine to give the wings a flapping motion. The design is copied from nature as far as possible, the Eagle being chosen as a model.

Calculations indicate a lifting force of 400 pounds. The dimensions are:

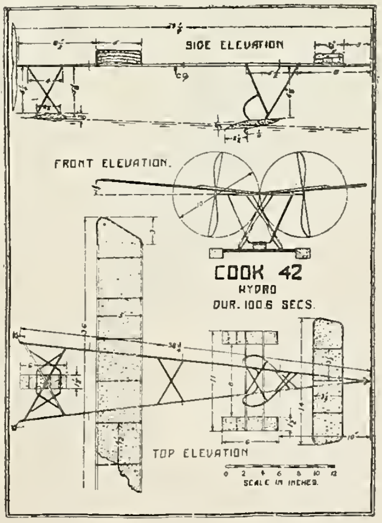
Wing spread, tip-to-tip	42 feet
Length, tip of tail to nose	15 feet
Height with wheels in position	7 feet
Chord, (min. O Lt.,) maximum	10 feet
Incidence Angle, (variable)	0 to 10 degrees
Radius of Flap at wing tip	8 feet
Weight per square foot	1½ pounds
Lifting surface of wings	240 sq. ft.
Aera of tail	30 sq. ft..
Engine	5 H. P.

Instead of using a propeller, flapping wings will be used, which is believed to be sufficient for "taking off." The engine will turn at 800 to 900 R. P. M., geared down to a crank turning at 30 r. p. m., to which the wings are attached.

Balancing in the air is to be accomplished by increasing the incidence of one wing while decreasing the angle on the opposite wing? Ascension to be made by increasing the angle of both wings, and descent by flattening the angle.

The Mechanical Properties of Metals

THE mechanical properties of metals may be most simply studied by considering the phases through which the



material passes when continuously loaded, say, in tension, until rupture takes place. Mild steel may be taken as an example.

If a steel bar is subject to an increasing load it at first stretches almost imperceptibly; if during this period the load be removed, it returns to exactly its original length. Thus it acts practically as an exceedingly stiff spring. During this phase it obeys "Hook's Law," which states that stress is proportional to strain. This law is usually written f=Ed where f is the stress in pounds per square inch, d the strain expressed as a fraction of the original length, and E is the ratio termed the "Modulus of Elasticity."

Suppose that the load be continously increased. A point is necessarily reached when the law breaks down. This is called the Yield Point. Up to the yield point the material is elastic, and on removal of the load reverts to its original size. Loads occassioning stresses beyond the yield point, however, cause the materials to take a permanent set.

A stress termed the Ultimate Stress, considerably greater than the yield stress, has to be applied before the material ruptures. Elongation between yield point and fracture may be considerable, depending upon the nature of the material. Failure finally occurs owing to local contraction at the weakest section.

A material which stretches considerably between the elastic limit and the point of ultimate failure is said to be ductile. This property is of great importance. Although the stresses in material under normal working conditions are well below the elastic limit, when excessive stretches occur which are liable to cause failure, the effect of ductility is felt. A ductile material has to give considerably before failure, and in so doing may avert failure by throwing part of its load on to other members of the structure.

Where sudden loads are anticipated ducility is essential. Cast metals as a rule have little ductility. They fail immediately after the yield point is reached.

The effect of stressing materials beyond their elastic limit is of interest. It is usually to harden them, that is, to raise the yield stress and to reduce their ductility. This effect is made use of in the manufacture of wire and sheet. These are rolled down from billets, the material being annealed from time to time to soften it. If the finished sheet is not finally annealed it will be much harder than the original material.

Fine steel wires may have an ultimate strength of well over 100 tons per square inch. Aluminum sheet likewise may have a strength of 15 tons per square inch, though the same material annealed would only stand 6 or 7 tons per square inch. A copper pipe that is bent or hammered is affected in exactly the same way. The ductility of materials can usually be restored by means of suitable heat treatment —steels by annealing, copper by quenching.

The effect of heat on the mechanical properties of metals is exceedingly important, particularly in the case of alloy steels. As working and heat have so great an effect on the properties of materials, care must always be exercised in subjecting parts to either. If a special steel axle tube, for example, be brazed, its mechanical strength at the point heated may be reduced by half.

When materials are subjected to constantly alternating stresses they become "fatigued." Engine parts are particularly liable to fatigue. A constantly vibrating wire is another example. Alternating stresses much below the yield stress of the material cause a gradual crystallisation or coarsening of the structure of the material, which reduces its strength considerably and robs it entirely of its ductility. Provided that a sufficiently low stress is used, it appears that an indefinite number of alternations of stress are possible without ill effect.

Latest List of Model Aeroplane Records

Supplementing previous lists of model aeroplane flight records published in Aerial Age, the list below gives the most recent records, corrected to the date of September, 1922. The list has been compiled by the Illinois Model Aero Club of Chicago, Ill., whose members have held the majority of records for several years past.

Some of these records will no doubt stand unbeaten for some time, but in many cases they can be equalled by those having the patience and skill acquired by I. M. A. C. members. The records are being shattered one by one, for the I. M. A. C. members are not content to let the records stand for any length of time. This friendly rivalry evidenced in the spirit of this club is one of the principal factors promoting its growth which can well be adopted by the more recent model clubs.

The I. M. A. C. offers its assistance to all interested in the scientific sport of model flying, and further information is to records etc. is available to those who direct their inquiries to Mr. Warren H. DeLancey, Secretary of the I. M. A. C., Auditorium Hotel, Chicago, Illinois.

LIST OF WORLD'S RECORDS FOR RUBBER DRIVER MODEL AEROPLANES

Type of model	*Kind of contest*	*Record*	*Held by*
Twin Pusher, Hand Launched	Duration	265 Seconds	R. Jaros
Twin Pusher, Hand Launched	Distance	5337 Feet	Thomas Hall
Twin Pusher, R. O. G.	Duration	209 Seconds	R. Jaros
Twin Pusher, R. O. G.	Distance	4029 Feet	W. Schwietzer
Twin Pusher, Hydro	Duration	172 Seconds	B. Pond
Tractor, Hand Launched	Duration	240 Seconds	D. Lathrop
Tractor, Hand Launched	Distance	2465 Feet	B. Pond
Tractor, R. O. G.	Duration	227.4 Seconds	P. Breckenridge
Tractor, R. O. G.	Distance	2685 Feet	P. Breckenridge
Tractor, Hydro	Duration	116 Seconds	L. Hittle
Indoor, Hand Launched	Duration	170 Seconds	B. Pond
Scale Model	Duration	21 Seconds	R. Jaros

The Orenco Fighter Model.

The Orenco Fighter makes a very pretty model, especially if all details are used in the construction.

A model of this machine was built from plans published in the March 14, 1921 issue of Aerial Age, by A. I. Mead of Norwalk, Conn. More detail has to be gone into in order to achieve a realistic appearance for exhibition purposes. The model having movable rudder, stabilizer and ailerons? The rubber and stabilizer being adjusted by screws from beneath the cockpit and the ailerons in the same manner.

The radiator, dummy motor and the top of the fusalage are of balsa. They are all removable as are the wings.

The motor stick is attached to the radiator, then making it easy to remove and repair the rubber band motor, which is composed of twenty-five feet of one eighth (⅛) inch flat rubber, driving a ten inch, four blade propeller. The two-blade propeller is used for exhibition purposes only.

Though weighing exactly one pound, complete, the model has made flights of about one hundred and fifty feet at a high rate of speed.

Enlargement of Activities at Chanute Field.

Chanute Field, Rantoul, Ill., is a busy place nowadays. Since the arrival of the Communication School from Post Field, Fort Sill, Okla., and the Photographic School from Langley Field, Va., the already busy routine of the post has been considerably enlarged. The question of room to be alloted to these various schools for purposes of instruction is somewhat of a problem, but is being met by the erection of additional steel hangers. One hanger has already been completed, and three others have been contracted for. The erection of several hangers in addition to this number is contemplated in the near future.

Among the new officers reporting at Chanute Field for duty with the Photographic School are Captain W. C. Wheeler, Air Service, Commanding; and 1st. Lieutenants Robert Cronau, J. P. Hodges, Stewart W. Torney and E. B. Robzien.

The school detachment consists of 25 enlisted men. Wtih the exception of Capt. Wheeler, all of the above officers came by airplane, ferrying over photographic planes from Langley Field.

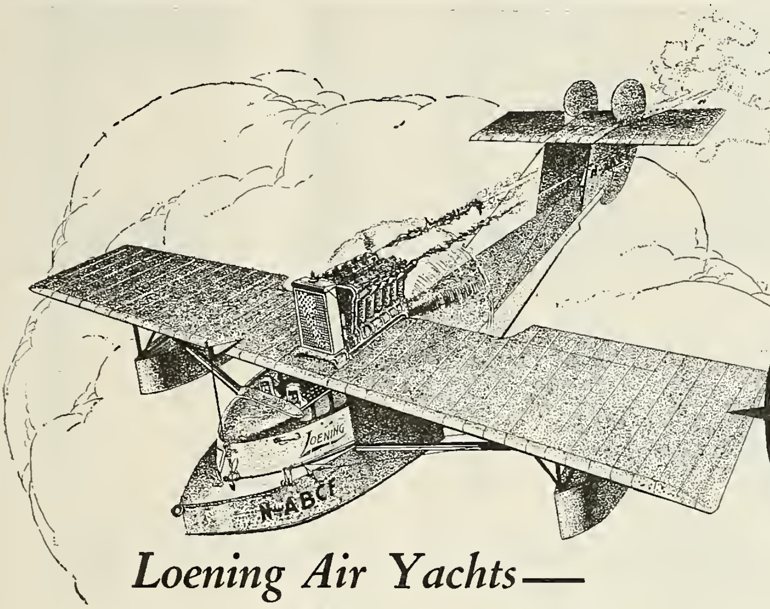
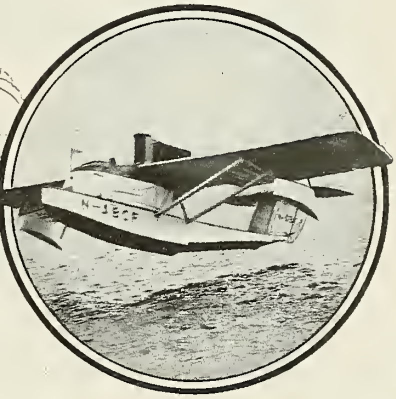


Photo below shows one of the air yachts—taking off from the water



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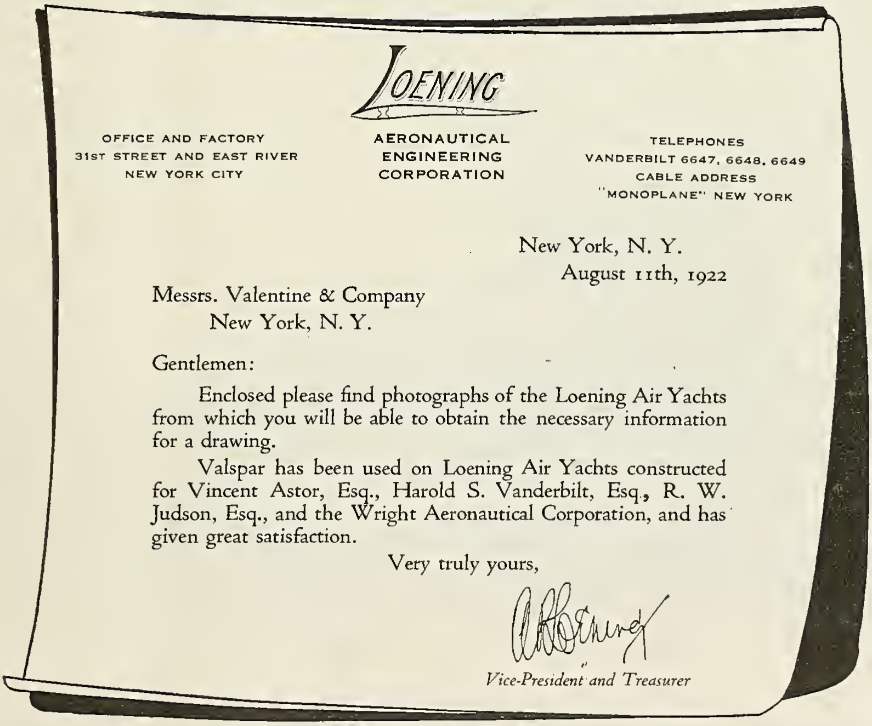

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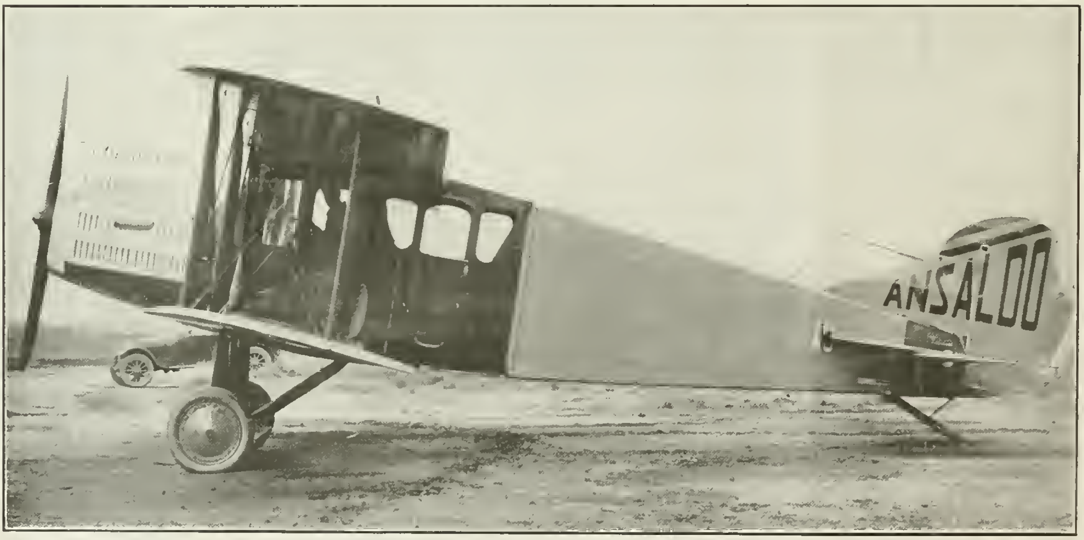

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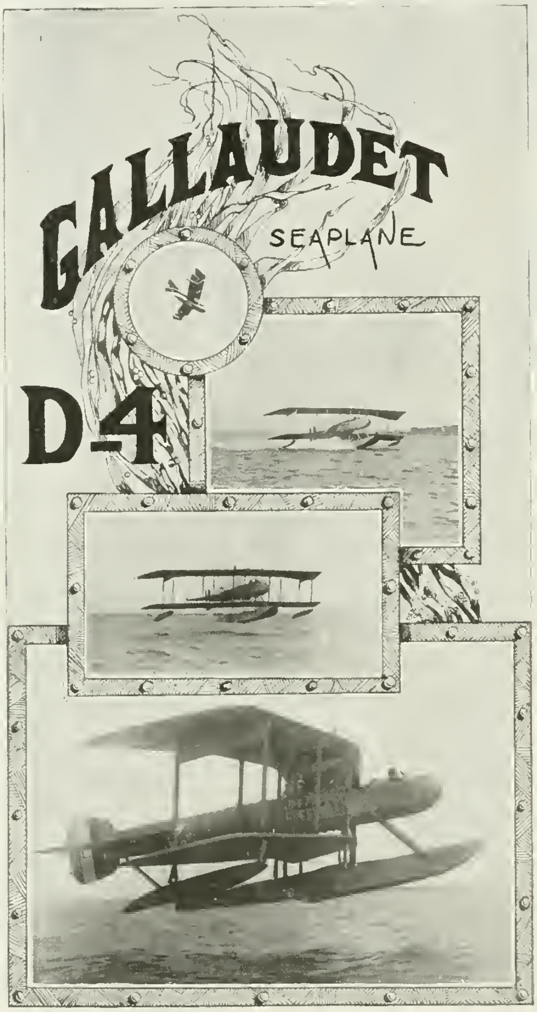

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(*Continued from page* 498)

effort should be made to plan for the future even if the immediate equipment is very modest. Although the aircraft industry is moving very slowly at present, it is growing nevertheless. There is no doubt that the tightness of funds, which came as a result of the war, has had much to do with the slowness of this growth.

The condition of financial stringency is passing and money rates are rapidly returning to normal. With money rates back to normal, those somewhat speculatively inclined will become dissatisfied with the usual low interest rates on gilt-edge investments. Such people may be expected to cast around for new investment fields offering greater returns, even if somewhat speculative, and the operation of aircraft on a comprehensive scale is very sure to attract their attention. At the same time, it has already been demonstrated that aeroplane transportation can be made to pay even on a comparatively small scale when properly managed. As the scale of operation is increased, with growing traffic, the revenue will increase very rapidly.

Considering all of this, it is by no means unlikely that the much-looked-for recovery of the industry will comes suddenly when it does come.

A New School Group in the Air Service.

Orders have been issued creating a new group in the organizations of the Air Service, to be known as the 10th Group (School), to be located at Kelly Field, San Antonio, Texas, and to consist of the following organizations:

- 39th Squadron (School) Pursuit
- 40th Squadron (School) Bombardment.
- 41st Squadron (School) Attack
- 42nd Squadron (School) Observation
- 43rd Squadron (School) Service
- 13th Air Park
- 22nd Photo Section
- 10th Group Headquarters Detachment.

Major John N. Reynolds, Air Service, will be in command of this new Group, which is to form the Advanced Training School of the Air Service. In its organization, it is contemplated that each of the present tactical groups of the Air Service shall furnish the nucleus of the new squadron which is to carry on its specialized work in the school. With this in view, the 2nd Group (Bombardment), which has been transferred to Langley Field, Va., has left some 14 officers and 100 enlisted ment at Kelly Field to form the nucleus of the 40th Squadron. The 1st Group (Pursuit), formerly at Ellington Field and lately transferred to Selfridge Field, Mt. Clemens, Mich., is transferring some 10 officers and 100 enlisted men to form the nucleus of the new 39th Squadron. The 3rd Group (Attack), Kelly Field, will furnish the nucleus of the 41st Squadron. Seventeen officers and 350 enlisted men are being transferred from Post Field, Fort Sill, Okla., to form the nucleus of the new 42nd Squadron, the 13th Air Park and the 22nd Photo Section. About 100 enlisted men are being transferred from the Lighter-than-Air branch (Brooks Field) to form the nucleus of the 43rd Squadron.

When the school group is completed, it is contemplated that the four different courses, which are now being given at three different stations, will be coordinated and fitted together in order that they may be given at one station. Pilots who graduate from this school will have good general knowledge of all tactical branches of the Air Service, as well as a very thorough knowledge of their own special branch.

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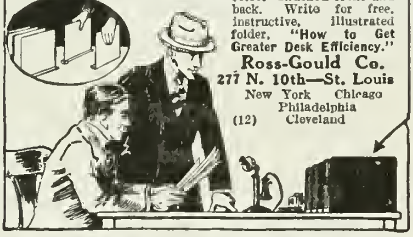

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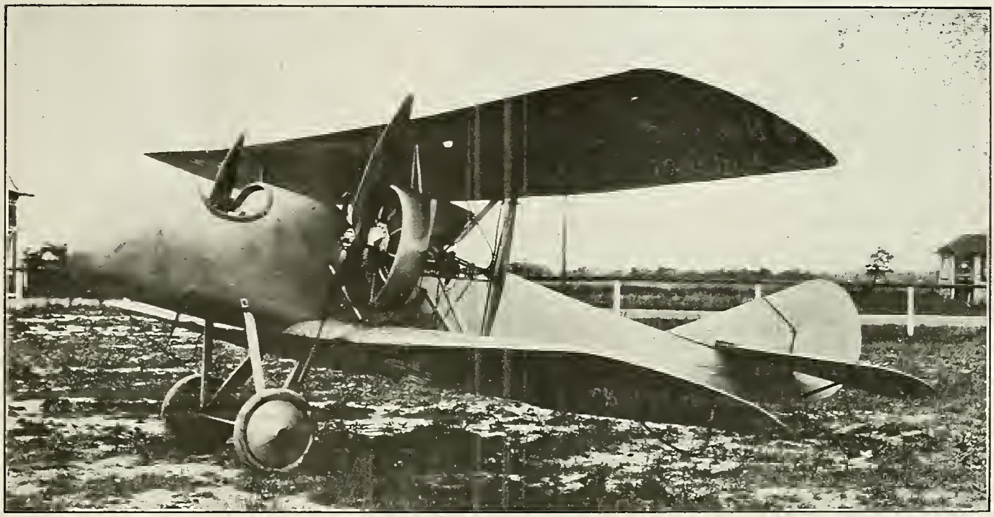

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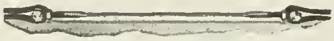

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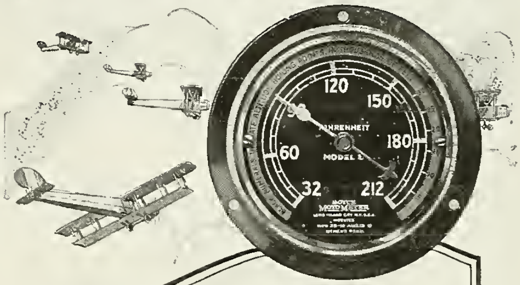

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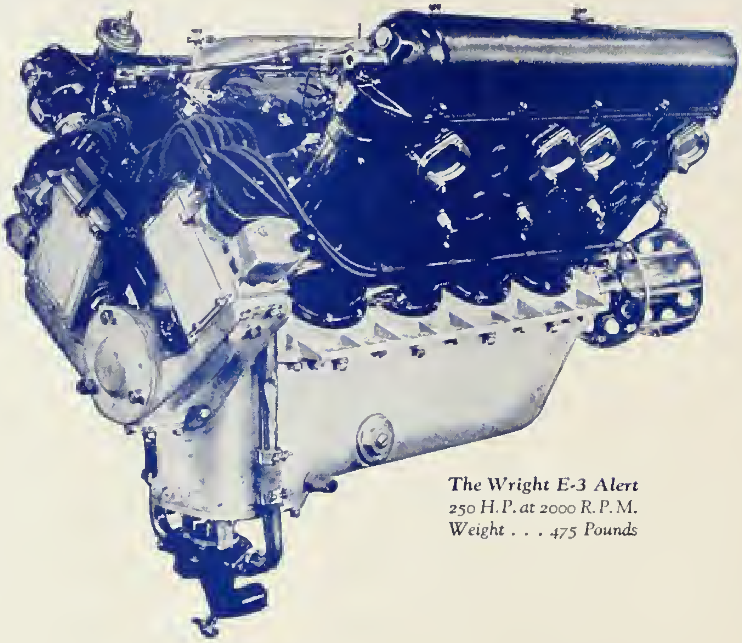

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PUBLISHED MONTHLY BY THE AERIAL AGE COMPANY, Inc., 5942 GRAND CENTRAL TERMINAL, NEW YORK CITY
Subscription: Domestic, $3; Foreign, $5. Entered as second class matter, March 25, 1915, at the Post Office at N. Y. under the Act of March 3rd 1879; also entered on September 22, 1922 at the Post Office at Bethlehem, Pa.

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AIRCRAFT YEAR BOOK

Edition of 1922

Published by Aeronautical Chamber of Commerce of America, Inc.

250 Pages Text; 40 Pages Illustrations; 40 Pages Aircraft and Engine Drawings

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World Records Established in Pulitzer Race

INTERNATIONAL aeronautic history was written at Detroit on October 14, when the year's aeronautic classic, the Pulitzer Race, was staged. The world's speed record was shattered by a good margin, and the Curtiss organization established a very unique record in having its ships take first, second, third and fourth place.

Having in mind the extraordinary speed attained by the contestants, another remarkable feature of the race was the entire lack of accidents. Several of the machines dropped out of the race, but no injuries were sustained by any of the pilots.

The order in which the pilots finished was as follows:

Lieut. Russell L. Maughan, army Curtiss racer, CD-12, 206.
Lieut. Lester J. Maitland, army Curtiss racer, CD-12, 203.
Lieut. Harold J. Brown, navy Curtiss racer, D-12, 193.2.
Lieut. Alfred J. Williams Jr., navy Curtiss racer D-12, 188.
Lieut. Eugene H. Barksdall, Sperry pursuit, Wright, 181.
Lieut. Fonda B. Johnson, Sperry pursuit, Wright, 178.
Capt. Corliss C. Moseley, Verville pursuit, Packard, 177.3.
Lieut. Eugene C. Whitehead, Loening pursuit, Packard, 170.2.
Lieut. La Clair D. Schulze, Loening pursuit, Packard, 160.9.
Capt. Clayton L. Bissell, Morse pursuit, Packard, 155.5.
Capt. Frank O. D. Hunter, Morse pursuit, Packard, 149.3.

The complete list of entries in the Pulitzer race was as follows:

Marine Corps: Capt. Francis P. Mulcahy, Thomas-Morse MB-7, Wright 400 horse-power.

Lieut. Lawson H. Sanderson, Chance Vought (mystery ship), Wright 400 horse-power.

Navy: Lieut. David Rittenhouse, Booth BR-W, Wright 400 horse-power.

Lieut. Stephen W. Callaway, Booth BR-1, Wright 400 horse-power.

Lieut. Alfred J. Williams Jr., Curtiss No. 1, Curtiss 400 horse-power.

Lieut. Harold J. Brown, Curtiss No. 2, Curtiss 400 horse-power.

Army: Lieut. Corliss C. Moseley, Verville HSP, Packard 600 horse-power.

Lieut. R. L. Maughan, Curtiss HSP, Curtiss 375 horse-power.

Lieut. Leslie J. Maitland, Curtiss HSP, Curtiss 375 horse-power.

Lieut. E. C. Whitehead, Loening HSP, Packard 600 horse-power.

Lieut. L. A. C. D. Schulze, Loening HSP, Packard 600 horse-power.

Capt. Frank O. D. Hunter, Thomas-Morse HSP, Packard 600 horse-power.

Lieut. Clayton L. Bissell, Thomas-Morse HSP, Packard 600 horse-power.

Lieut. E. H. Barksdale, Sperry HSP, Wright 350 horse-power.

Capt. St. Clair Street, Sperry HSP, Wright 350 horse-power.

Lieut. Fonda B. Johnson, Sperry HSP, Wright 350 horse-power.

Capt. Albert M. Guidera, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. Benjamin R. McBride, Thomas-Morse MB-3 Wright 300 horse-power.

Capt. H. M. Elmendorf, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. Donald F. Stace, Thomas-Morse MB-3, Wright 300 horse-power.

Capt. Oliver W. Broberg, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. James D. Summers, Thomas-Morse MB-3 Wright 300 horse-power.

Lieut. Thomas K. Matthews, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. George P. Tourtellot, Thomas-Morse MB-3, Wright 300 horsepower.

The abbreviation HSP, means high speed pursuit.

The story of the race by Frederick Pasley, staff correspondent of the New York World gives an excellent impression of the spirit of the race.

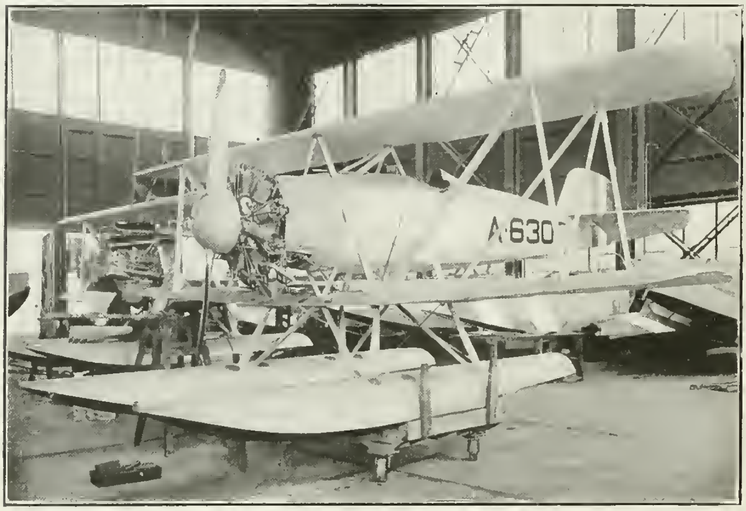
It was a race without a spill. There were four forced landings but all planes were brought down under control. Contrary to the expectations of the thousands who journeyed to Selfridge Field, every pilot who went up came down safely.

It was a personal triumph for Glenn H. Curtiss. He is established beyond cavil as the world's foremost aeronautical engineer. His judgment on wing radiation and stream lining has been completely vindicated.

So certain were army officials of what his ships would do that they withdrew the eight Thomas-Morse MB-3 planes a few hours before the race. They were flown early in the day for the Mitchell Trophy, donated by Brig. Gen. William Mitchell in memory of his brother, who was killed in France.

Of the other Pulitzer entrants Lieut. David Rittenhouse, navy pilot of the Booth racer, withdrew because of engine trouble before taking the air.

The Army-Curtiss Racer, winner of the Pulitzer trophy, and its pilot Lieut. R. L. Maughan



The TR-1 Naval Seaplane, winner of the Curtiss Marine Flying trophy, equipped with Lawrance radial engine piloted by Lt. A. W. Gorton

Capt. Francis B. Mulcahy of the United States Marine Corps, piloting the Thomas-Morse MB-7 overhead wing monoplane, was forced out after completing two laps because of overheated oil in the lubricating system. He was averaging about 140 miles an hour.

Lieut. Lawson H. Sanderson, in the widely heralded navy mystery ship with the Wright 600 horsepower engine, had to land in a golf course when similar trouble developed on the fourth lap. He was averaging around 186 miles an hour.

Lieut. Stephen W. Callaway, also of the navy, piloting Booth Racer No. 2, had to take the ground at the beginning of the second lap because of a broken oil lead. He had made the first lap in 163 miles an hour.

Capt. St. Clair Street completed four laps in his Sperry high speed pursuit, powered with a 350 horsepower Wright motor, and then bugs developed and he had to land in a a golf course a half mile back of the Grand Island. He brought his plane down safely. He was averaging 165 miles an hour.

Two Navy Craft Finish

The only ships that finished for the navy were the Curtiss racers. piloted by Lieut. Albert J. Williams Jr. and Lieut. Harold J. Brow. Each flew a good race. Brow in particular handled his ship at the pylons with a craftsmanship almost equal to that of Maughan.

Brow's time for the race was 193.2 miles an hour. Williams's time was 188. Brow's ship has wing radiation. Williams carried two Lamblin radiators, open mesh ovals that look something like wire waste baskets. The resistance of the Lamblin is said to have decreased Williams's speed by fifteen miles an hour.

Hangar gossip had had Maughan a winner weeks ago. Maitland is a skilled pilot. He is at home in any kind of a ship. But Maughan belongs to that rare species—a birdman to the manner born. There are few like him. Hunter is said to be his nearest approximation at Selfridge Field.

After the race had started and a line had been gained on the other entrants, particularly the freak machines of which so much had been whispered, it was apparent that Maughan and Maitland would battle it out.

216-Mile Speed on One Lap

And at the end of the first lap, when the judges announced that Maitland had made the circuit at 216 miles an hour, the grand stand and press box were in a turmoil. They couldn't believe it. The judges, however, insisted that was his time.

In any event it changed the complexion of the race. Maughan's average for the first lap had been but 206. Then Maitland's average for the second lap was announced—200. Maughan crossed the timers' wires the second time, averaging another 206.

Maitland on his third lap slipped back to an average of 197 miles an hour. Maughan was timed at 207. It was apparent that an error had occurred in the computation of Maitland's first lap, or that he had unconsciously lost his way and skipped a pylon at either Gaulkers Point or the United States cruiser Dubuque. But no rectification was made.

Maughan's average for the fourth lap was 205 miles and for the fifth and final 206. Maitland averaged 203 for the fourth and 200 for the fifth.

Maughan was the first to land.

The Curtiss Marine Trophy Race

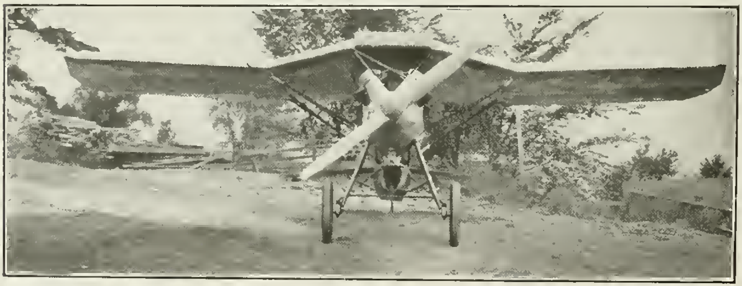
The Curtiss marine trophy race was flown October 8 under lowering skies and in a boisterous air. Eight naval seaplanes started in the 160-mile flight and two finished. The winner, piloted by Lieutenant A. W. Gorton, United States Navy, was the T R-1 ship-plane. It covered the course of eight twenty-mile laps with three landings at an average of 112.65 miles an hour.

The second ship to finish was the Standard Vought observation seaplane, driven by Lieutenant H. A. Elliot, who attained 109 miles an hour.

In the course of the race, six contestants were forced out, one because of engine failure, one from loss of radiator water, two from propeller trouble, one from exhaustion of gasoline and one from a broken wing tip pontoon.

Lieutenant Gorton, the winner, flew a perfect race. His water work was especially good, as he slid into the water controls at the end of the fifth, sixth and seventh laps without shock or "porpoising."

Gorton belongs to Pawtucket, R. I., is a war veteran and participated in the second battle of Verdun as a member of the Ambulance Corps of



The Thomas-Morse Army Racer

The Verville-Sperry R3 Army Racer, equipped with 400 H. P. Wright engine

the French army. He transferred from the French army in 1917 to naval aviation. He has had more than 1,200 hours in the air.

The T R-1, which carried off the honors of the day was designed by Commander J. C. Hunsaker, of the Bureau of Aeronautics, United States Navy, and built at the naval aircraft factory in Philadelphia. It is powered with a twenty horsepower Lawrence Radial air-cooled engine, a new development in American engineering practice.

Liberty Engine Builder's Trophy

Lieutenant T. J. Koenig, in a Detroit-built plane, equipped with a Detroit-made motor, won the race for the Liberty engine builders' trophy October 13 over the 240-mile triangular course, with an average speed of 128.8 miles an hour.

The plane, a Lepere observation, was built by the Packard Motor Car Company, as was its engine, Liberty 12, 400 horsepower. It is the same plane in which Lieutenant C. J. MacReady established the world's altitude record of 37,000 feet last year.

Lieutenant Koenig varied not more than two miles an hour in any lap from his average speed for the ten laps. The first three laps he made at 130 miles an hour, the next five at 129 miles, the next five at 128 miles, and the last lap at 129 miles an hour. On the last leg of his last lap, while he was over Lake St. Clair, his air pressure feed, which forced gasoline to the carburetor from the tanks went wrong and he was compelled to resort to an emergency gas tank for fuel.

Second place in the race went to Major Follett Bradley in a De Haviland 4-B observation plane. He averaged 126.4 miles an hour for the ten laps. Major Bradley is a graduate of Annapolis.

Lieutenant W. L. Boyd, also piloting a De Haviland 4-B observation plane won third place. He flew a perfect race, averaging 122 miles an hour in every one of the ten laps. Army men said this was a remarkable achievement.

Only six of the nine starters in the race finished. Fourth place went to Lieutenant W. R. Carter, in a De Haviland 4-B observation plane, with an average speed of 118.1 miles an hour; fifth place, to Lieutenant J. D. Givens in another De Haviland, averaging 114.1 miles an hour, and sixth place, to Lieutenant B. R. Morton, also in a De Haviland, who averaged 112.8 miles an hour. Lieutenant Givens made the most spectacular race, his turns being hair-raising.

Detroit News Contest

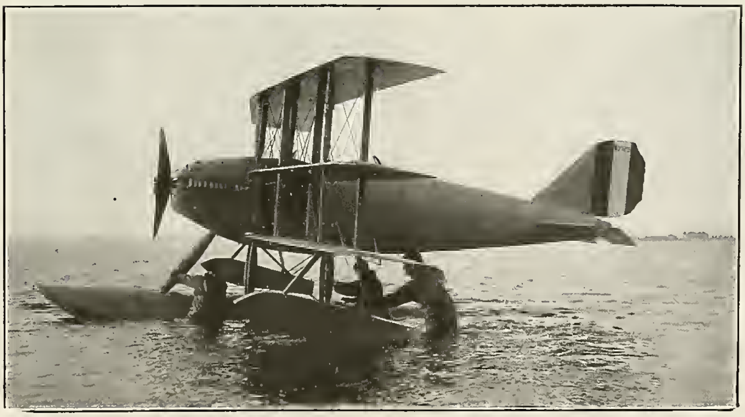
Piloting a Martin transport, driven by two 400-horsepower Liberty motors, Lieutenant Eric H. Nelson of Montclair, N. J., won the Detroit News aerial mail trophy race for multi-motored planes October 12. He covered the 240-mile triangular course at an average speed of 105.1 miles an hour.

The Detroit Aviation Country Club trophy race, flown over the same course, was won by Lieutenant Harold H. Harris, one of the two army entrants, in the "Honeymoon Express," equipped with a 400-horsepower Liberty 12 motor. Lieutenant Harris averaged 135 miles an hour in this event, which was for light commercial planes, finishing four laps ahead of C. S. Jones, in a Curtiss Oriole, who averaged 110 miles an hour.

A stiff northwest wind blowing at the tail of the big planes in The Detroit News event made necessary abandonment of the original plan of starting all of the craft together. Consequently the planes, each weighing five tons and having a wing spread of seventy feet, took the air one after the other, Lieutenant Nelson's plane being the last to cross the starting line. The transport began at once to overhaul the other racers, and before the race was three-fourths over it was seen that unless forced down, Lieutenant Nelson would win.

All but one plane of the nine entered in the two events finished. James M. Johnson, in a Vought V. L.-7, was forced down in the fourth lap when dirt fouled his carburetor. He landed near the Mount Clemens Golf Club and ran into a ditch, damaging his landing gear and both wings. Neither Johnson or his two passengers were injured.

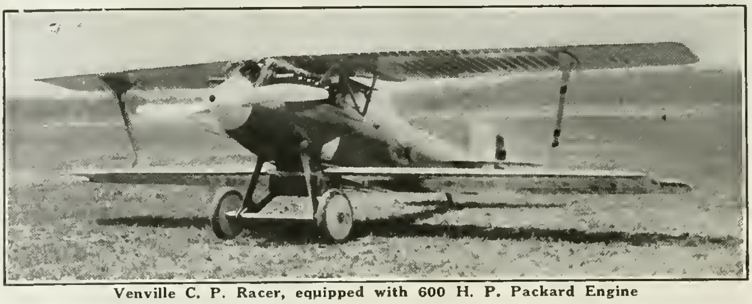
Lieutenant Nelson, who, when he alighted from his plane at the finish, was warmly congratulated by Major Gen. Mason M. Patrick, Chief of the Army Air Service, carried three army privates during the flight. Both Lieutenant Nelson and Lieutenant Harris ascribed their victories to the "good planes" they piloted.



The 18T Curtiss Triplane, equipped with CD-12 Curtiss Engine, which won the prize for speed in Curtiss Marine Trophy Race

Lieutenant Nelson was one of the pilots in the army's New York-Alaska flying expedition in 1920. Lieutenant Harris is a McCook Field, Dayton, Ohio, pilot.

Twelve hundred dollars was awarded winners of the two races, in addition to the trophies. Prizes of $600 and $200 were awarded, respectively, to second and third places in both events.



Venville C. P. Racer, equipped with 600 H. P. Packard Engine

Across the Continent in Twenty-two Hours

Doolittle's Transcontinental DH4B Alterations—Other Transcontinental Flights

Lieut. Doolittle's Wonderful Feat

SEPTEMBER 5th, was a red letter day in the history of aviation in this country for it marked the successful culmination of a remarkable airplane flight across the United States from the Atlantic to the Pacific Coast within the elapsed time of 24 hours, the first time such a feat has ever been accomplished.

A young Army aviator, tired and exhausted from the strain of his long flight, his eyes heavy for lack of sleep, but happy in the thought that he had accomplished his cherished ambition, hopped out of his plane at Rockwell Field to greet his admiring comrades in the service who had gathered to meet him. This pilot, with a string of aviation achievements to his credit that belies his name, Lieutenant James H. Doolittle, broke all previous existing records for a flight across the continent, his actual flying time being 21 hours and 20 minutes, and his elapsed time 22 hours and 35 minutes, a stop of an hour and fifteen minutes being made at Kelly Field to replenish his fuel supply.

Following Aerial Age prints a detailed list of all the changes made in the DH4B used by Lieut. Doolittle in his record one-stop transcontinental flight. A new main gas tank of 240 gallons was installed immediately back of the engine, necessitating the moving back of the pilot's cockpit, changes in location of struts, control and brace wires and a number of others, including a lift wing on the axle.

a. The two vertical fuselage struts at station ten were moved back about 4″ to a point directly over the spreader bar between the rear spars of the two lower wings and the fuselage brace wires in back of the engine were moved forward two and three-quarters inches at the top in order to accommodate the two hundred and forty gallon main gas tank. Normally the tank is of 88 gallon capacity The controls and front pilot's cockpit were moved back sixteen inches for a similar reason and the aileron control was turned around so that the arc was in back of the pilot's seat. This was in order to allow the main gas tank to be as deep as possible and necesitated an extra set of pulleys in the aileron controls.

b. The cross brace wires under the tank were removed and 1-⅛″ laminated wood braces put in, in front of and in back of main tank to take the strain. That left a 1-⅛ by 3 in. laminated wood brace between the landing gear fittings instead of the standard 1″ by 3″ spruce compression members.

c, The Year or observer's cockpit was boxed in with 3/16″ 3-ply veneer adding great strength to this inherently weak part.

d. A ¾ x 1-¼″ ash brace was placed under the top longerons for a distance of eight feet to prevent bowing and to add strength.

e. Six vertical compression members were added between station ten and the engine to transmit the weight of the gasoline tank from top longeron to bottom.

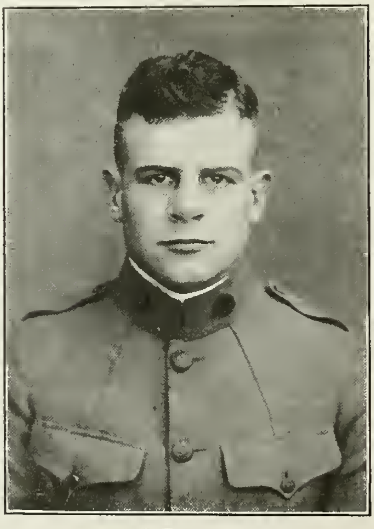
f. The tail skid post, axle and shock absorber bars were reinforced by having an extra seamless steel tube driven into them their entire length.

g. Old style DH-4A ash landing gear was used for strength and also because it is four inches higher and would so raise the lower wings into a more efficient position and give more clearance for the

h. A wing 17″ x 48″ was built on the landing gear fairing and set at an angle Martin propeller.

of incidence one-half of a degree less than that of the wings.

i. The tank cowl was raised 1-¾ inches to allow for the higher gas tank and also to give a slight camber to the top of the fuselage. An effort was made to concentrate the weight of gasolin as near the center of lift of the ship as possible, in order that the pilot could sit forward where he had better control and also so that the balance of the ship might be maintained at all times. This was realized and the oil tank forward so well balanced the large gas tank that it was not necessary to touch the stabilizer at any time between full load and empty.



Lieut. James H. Doolittle

j. The main gravity full tank held thirty gallons and was placed between the spars in the center section. There was a 1-½ gallon expansion tank for water in the leading edge of the center section. The oil tank held 24 gallons and was placed under the motor and held in place by three straps running to the upper longerons.

k. The syphon system of gasoline feed was used and found to be most satisfactory.

l. The main gas tank was notched out for a distance of nine inches to allow it to set down over the spreader bar between the front spars of the lower wings. A 1-¾″ hole in the tank allowed room for a rod to tie the longerons together.

m. The bottom of the fuselage was dropped and lowered so that it made a perfect streamline from radiator cowling to tail.

n. The wings were of selected spruce, care being exercised to pick out the lightest possible frames. The extra ribs in the inner bay were spliced and ran out to the trailing edge. An extra rib was placed in between each rib in the outer bay and the ailerons each had an extra rib between each regular rib. The fabric was sewed on with a 1-½″ stitch instead of a 3″ stitch. The wings were given four coats of dope, two of pigmented dope and one of varnish. All of this added about ten pounds to each wing but greatly strengthened them and the extra ribs allowed the wing panels to retain their original shape and this increased their efficiency.

o. The "ship" had an excellent performance. Took off in about three hundred and fifty yards full. Climbed seven thousand feet in fifteen minutes at 1550 R.P.M., and flew about 100 M.P.H. full and 105 M.P.H. nearly empty at 1480 R.P.M.

(*Concluded on page* 561)

How the Fastest Aeroplane in the World Was Built

THE victory of the Army-Curtiss racer, which flew faster than any machine has ever travelled before, is no more remarkable than the speed with which the aeroplane was built. The design had been submitted to the Navy Department as representing a year's improvement on the Curtiss-Navy racer which won the Pulitzer Trophy race of 1921. But the Navy seemed reluctant to order a plane built by the same company to compete against the fastest plane existing in the service.

Believing in the unparalleled efficiency of this design, private interests were sought to sponsor its entry in the race. The time for the race was drawing near and there seemed no chance of demonstrating its true worth. Then came a request from the Army for a pursuit design embodying just such features as possessed by this ship, bringing it to the favorable attention of Air Service officials. Arrangement was soon made for the construction of two test ships to fulfill the apparently daring predictions made for their performance.

A year's time is usually allowed for the building of any new type of aeroplane; this was an unusual design and under ordinary conditions the time would have been too short. But instead of extending the period of construction, a new condition arose which completely upset existing ideas on time limits and customary routine procedure in the matter of aeroplane building—the Air Service wanted those two ships built in less than 90 days. Contracts previously let to other companies for racing planes called for delivery in time for the Pulitzer Trophy race, the speed classic of the year, which brings out the best speed possible in each of the ships entered. Could Curtiss build the ships in time to compete against the others?

Under ordinary conditions, the answer would be in the negative. It would be impossible. Government aeroplanes of various types were in production at the Curtiss Plant—large bombing planes were moving along through their various processes of production with clockwork regularity. No, it would never do to risk holding up any part of the work already under way, and there was no part of the factory which could be set apart for the purpose. But the Government wanted those new ships at once, for the design showed a ship capable of outclassing the best of them and therefore *must* be built in time for the race.

A consultation by the officials, engineers and heads of departments brought to light several interesting points which gave a promising aspect to the situation. The employees in every department united to carry through the decision arrived at; the work could be done, for the men were willing to sacrifice themselves to do it. It was a real test of their skill and of loyalty to their government. The question was settled then and there that the Army would get the ships in time.

The workers volunteered to give up their recreation building where noonday and weekly dances were held. The building was quickly transformed overnight into a factory complete in itself—all the necessary wood-working and metal machinery was installed so that work on the racers could proceed with no effect on the other work in the main shops.

While the equipment was being put in readiness, other work was proceeding in the Engineering branch, where the design goes through some very essential processes before reaching the shop. In the Mathematical and Design Analysis Departments, calculations are made of the structure as a whole and of the important units which comprise the machine. Determinations are made of the proper materials to use and the sizes required for safety. In the Research Department, investigatons are made of the theories and assumptions upon which the calculations are based, and tests made to verify the correctness of the design by means of "wind-tunnel" experiments.

An important feature of the wind-tunnel work is the testing of accurate models, made in the Model Shop. These models are exact miniature reproductions of the aeroplanes to be tested. So necessary is accuracy in these models, that in true scale they do not depart from the figured dimensions more than 1-4000 of an inch. The slightest inaccuracy in constructing them would render the tests worthless. In the wind-tunnel, the model is suspended in an artificial air stream which simulates the conditions existing in flight. By means of indicators and scales, it is possible to determine immediately the performance and degree of stability which can be expected in the finished aeroplane. In this connection, it is interesting to note that wind-tunnel tests showed the Curtiss-Army racer to be capable of a speed of 219.8 miles an hour, whereas on its first flight, the official timing of its actual speed showed it to be 219.5 miles; this varies less than one-quarter of 1 per cent. from the predicted performance for speed. The balance of the finished machine checked up perfectly with the preliminary recommendations of the Research Department.

Materials were tested in the chemical laboratory, where formulas for special steels and compositions are originated. Careful tests are made of many materials entering into the construction of the aeroplane so they may be selected to give the best possible service.

In the Physical Laboratory, wing ribs and tail units, etc., of the proposed design were built up and loaded with weights to represent the stress imposed during flight. Determination is made of the breaking point of each part so that weak places can be strengthened and parts proving too strong for the work required of them can be lightened. In this way, before the actual machine is built, there is no question about uniform strength throughout, no uncertainty about the reliability of the materials used and no doubt about its performance.

As parts were tested and found satisfactory, drawings for their construction were released to the shop. Shop foreman and many of the men skilled at special jobs were at work in stretches of from twelve to sixteen hours daily.

The wing radiators were a problem at first. Radiators of this principle had proven their worth in other Curtiss aeroplanes tested in the months preceding their adoption for the racing design. But complete wings such as these had never been built before, and the fact that they proved successful in a high-speed racer reflects great credit to the engineers responsible for them and the men whose patient work made it possible to complete them without mishap. The wing-radiator was adopted only after considerable research work was carried out to ascertain its advantages over the conventional forms of radiators. The idea was patented by the Curtiss Company some years ago and might have been used in connection with the Gordon Bennett Racer of 1920, but having no absolute data on their value, it was considered best to experiment with them until they became perfected before depending upon them for racing purposes.

Wing radiators of different forms and materials were applied to some of the Curtiss "Oriole" aeroplanes, where their efficiency was soon established. An Oriole plane with such a radiator was flown from New York to Kansas City, Missouri, a distance of about 1500 miles, at a speed averaging 100 miles an hour.

For many years it has been the aim of aeronautic engineers to reduce the head-resistance of radiators, and to do away with this resistance entirely is an advancement worthy of note. With wing radiators, the usual resistance of ordinary radiators is eliminated, which in turn adds to the speed of the aeroplane. In place of the automobile type of radiator, the engine water is cooled by circulating through narrow cells formed by corrugations of thin sheet brass with which the wings are covered. The surface friction of the air flowing past the wings must exist anyway and the wing radiator puts this air contact to good purpose. It has been established that this form of radiator has added not less than 12 miles an hour to the speed of the Racer. As to their reliability of functioning, after the first trial flights the pilot found nothing that required altering and further flight tests were continued with no adjustment necessary to any part of the system.

In connection with the water cooling system an original oil temperature regulating system is provided. It is well known that water heats up quickly as it circulates through the engine; also, the lubricating oil is slow to heat up, being so heavy. An ingenious method of locating an oil radiator in the water cooling system insures not only that the oil will be warmed up quickly, but also that its temperature will be kept uniform once it reaches the same temperature as the water in the radiator.

It is not possible to attribute the success of the Army Curtiss racer to any feature of its construction, for so many improvements exist throughout the design. A good share of its success, however, is due to the men in the various departments of the Curtiss plant—Executive, Engineering, Mathematical, Research, Chemical and Physical Laboratories, Designing, Drafting, Experimental, Model, Woodworking, Metal Working, Welding, Radiator, Sheet Metal, Covering, Doping and Painting, Heat Treating, Sand-blasting, Plating, Wire, Propeller Department, the Motor Factory, and Motor Testing Laboratory, Machine Shop, Inspection Department, all combined in one purpose—to build the fastest aeroplane in the world.

1921 Curtiss-Navy Racer Speed Increased 16 Miles

THE Curtiss-Navy racer in the Pulitzer Trophy Race of last year, proved to be the fastest plane entered. Its winning speed was 177 miles an hour.

The Navy Department, wishing to enter this machine again in the 1922 race, gave the Curtiss company the opportunity of improving it in an effort to increase its speed. A year's progress in aeronautics made it possible to incorporate changes which reduced resistance and increased the lift to such an extent that a gain of 15 miles an hour was made in its speed. In an entirely new ship the increase would not have been so remarkable, but in this case the plane used in the experiment is the identical ship which won the race last year.

At slow speed, the resistance of an aeroplane is correspondingly low and irregularities in outline as well as blunt surfaces presented to the air are not of great moment. But as speed increases, resistance increases not in direct proportion but in a ratio of the "square of the speed"; in other words, if a wire, strut or other portion of an aeroplane has a resistance to the air of, say, five pounds when the machine travels at 100 miles an hour, at 200 miles an hour the resistance would not be ten pounds, as might seem natural, but would be four times that force, or twenty pounds.

At high speed, the retarding force of the air becomes the factor which limits the maximum velocity obtainable in an aeroplane.

The two French "Lamblin" radiators used before were the most efficient known, as their resistance to the air was the lowest by comparison with existing forms of radiators of the required capacity. Even so, their resistance at 180 miles an hour was about 50 pounds. By replacing the Lamblins with wing radiators, this resistance was entirely eliminated and still adequate cooling was retained.

In the wing-radiator, the water for cooling the engine circulates between double sheets of corrugated brass which cover the wing surfaces. The metal wing surface therefore dissipates the heat of the water by transferring it to the air, and thus the water is cooled without any additional apparatus exposed to the air. Before adopting this radiation principle, it was tested in all kinds of flight conditions during a period covering several months. During this time, sample radiators were installed on some of the Curtiss commercial planes, and cross-country flights, one of over 1500 miles, were made without mishap. Improvements brought about by the experience gained from actual use made possible their adoption for the racer with certainty about their efficiency.

A new wing-contour was adopted. This is the C-27, having less resistance and a higher lift at high speed than any wing ever tested. This shape was evolved in the Curtis aerodynamic laboratory.

Streamline caps were fitted around all bolt heads and fittings, which project into the air stream. Corners and angles formed by the intersections of surfaces were filled and rounded out with Balsa, the lightest wood existing. Wire terminals were encased in smooth shells which tremendously reduced their resistance.

An original idea was carried out for covering the spaces between fixed and movable tail surfaces; that is, between fin and rudder and between stabilizer and elevators. Strips of sheet rubber were spread across the openings, attached at the edges with linen tape, leaving the surface perfectly smooth at all times, but not restricting the proper movements for control.

A most important change has been made in the contour of the wheels. The most up-to-date method of streamlining a wheel has been to cover the sides with linen. Curtiss Engineers set about to improve on this with the result that a saving of 37 per cent. of the wheel resistance was affected. The result was accomplished only after extensive calculations and tests had been made. Several wheels of varying side contour were tested in the Curtiss wind-tunnel, where their relative merits were determined by scale balances showing the resistance of each. It was found that a wheel with a full elliptical section went through the air with the greatest saving of power. Building out the sides of a wheel to the determined contour was easily accomplished with sheet aluminum discs, covering the whole unit, discs and tires with linen, doped and varnished. The use of these wheels gave the machine an increase in speed of 1.3 miles an hour, equal to a total saving of 10 horsepower for both wheels at high speed. Streamlined cast aluminum hub caps and a streamlined tailskid completed the landing gear improvements.

Trivial as some of the changes appeared, and in spite of the extra weight their incorporation necessitated, the additional speed and efficiency obtained indicates the advancement being made by practical engineers of the largest pioneer aeronautic organization constantly engaged on improving the best existing aeroplanes, employing the most modern testing equipment and methods.

Lighthouse Developed for Night Flying

IN preparation for the night flying which will soon be undertaken by governmental and civilian aviation interests, the Aeronautical Chamber of Commerce announces the development of two types of aerial lighthouses to mark and illumine the way from New York to San Francisco. One of these devices, a beacon, is already in operation at Hampton Roads under the supervision of the Navy Bureau of Aeronautics; another a ground wind indicator, is being installed by the Army Air Service at Dayton, Ohio; while the Post Office Department, as was indicated recently by Colonel Paul Henderson, Second Assistant Postmaster General, is negotiating for equipment to be installed either between New York and Chicago or Chicago and Cheyenne.

The development of these lights is another indication that the United States is not lagging in aviation. At Elizabeth, N. J. is located the plant of the American Gas Accumulator Company, the United States unit of an international corporation. Immediately after the Armistice, the British Air Ministry requested the Englsh unit of this corporation to work on the illuminating problems of night flying with the result that lighthouses were established for the London-Paris route, first at Croyden, near London, and later in Kent. The American unit, which had specialized in marine and lighting signalling devices, began where the British unit left off and is now carrying on experimentation which promises significant development in the near future.

"The problems of night flying," according to E R. Boots, General Manager of the American Gas Accumulator Company, "resolves itself mainly into a question of setting signals to keep the pilot on his route and so illuminating emergency fields and terminals that he can land safely into the wind. With the present encouraging application of radio and utilization of the compass in aerial navigation, the ground light is of primary importance. We consequently have developed what is known as the *Aga* Automatic Ground Wind Indicator. This apparatus has been designed to fulfill the purpose its name implies, and it is intended to act as a signal to aviators both by day and night. It is intended for use upon emergency and other landing grounds where no personnel is available. The whole unit is entirely automatic in operation and when installed in its permanent position it will be equipped to operate without human attention of any kind for periods of six months to one year. It is in the form of the letter T, and very nearly approximates the style internationally agreed upon to indicate landing zones. The three vanes are mounted in such a manner as to receive upon their upper surfaces light projected through the dioptric lenses fitted round the light source, and these lenses together with the vanes are free to rotate about a vertical axis. By the employment of a suitably designed rudder the head of the T unit is equipped with the Gas Accumulator wind. It stands five feet high.

"The light power projected upon each of the vanes is 27,000 E. S. candlepower. It can be seen as a day signal at a range of about 5 miles when observed from normal flying heights. As a flashing light without definite shape, it can, at night, be seen from about 12 miles, and its shape and bearing can be clearly established from a distance of two to three miles. This unit is equipped with the Gas Accumulator Company's Sunvalve and gear for automatically changing mantles.

"The sunvalve is an interesting feature. It is worked by the action of solar radiation and is so designed as to be operative under any temperature changes. Briefly, the system employed is that a central black body is surrounded by highly polished pillars; light, and therefore heat, falling upon these elements, is absorbed by the black center and reflected by the outer gilt columns. Consequently the black portion expands under a given influence to a greater extent than the polished elements; this difference in expansion is utilized to open and close a gas valve, turning the light off and on according to the prevailing degree of light and darkness. A valve of this type brought the Croyden light into action during the last eclipse of the sun.

"It is a light of this type that we are installing at Dayton, for the Army. It has been our recommendation for both the Army, along the Model Airway, and the Post Office Department, on the Chicago-Cleveland Route, that they survey the route to determine suitable emergency landing fields, which shall be located not more than twenty miles apart, and that one of these automatic Ground Wind Indicators be installed to mark each of these fields, so that a flier can hop from one to the other, and in case of a forced landing, will always be able to glide to the field ahead of him or the field over which he has just passed. He will be able to determine the direction of the ground wind when he gets within three miles of the field, and by having these lights located in the same position in each field, the flier will be able to determine his landing space from the location of the light.

"As the ground lights will not be visible for great distances, it will be necessary, just as with marine transport, to provide great beacons for the airways. The *Aga* Beacon has a light range of over 35 miles.

It is a small unit of this general type twelve months without attention. It is of the revolving type, the rotation of the lenses being obtained by the movement of certain sensitive diaphragms which are operated by the gas passing under pressure to the burner; on the light being extinguished by a sunvalve the optic ceases to rotate.

It is a small unit of this general type which is now being tested by the Navy at Hampton Roads.

"Our aeronautical engineers recommend that one of these large revolving aeronautical lights of very great candlepower be located at convenient points along the route that is to be flown by night at distances of forty or fifty miles apart. These lights are to be located on promontories where they will have the maximum range of visibility, and will have a code flash so that each one may be identified by the flier. Their value will be to lead fliers back to the airway in case they stray from it on account of fog or storm. These lights also have the advantage of giving the aviator definite information regarding his location when he has returned to the route, or when there is a question of his position after flying above clouds or through fog. These lights are similar to the ones which are giving the British Air Service so much satisfaction on the London-Paris Route."

Simple Formula for Estimating Aeroplane Ceilings

By Walter S. Diehl

Summary

THE absolute ceiling of an average aeroplane is given to a close approximation by

$$H = 19000 \log_{10} \frac{10000}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)}$$

where

H = absolute ceiling, in feet

$\left(\frac{W}{HP}\right)$ = "power loading," based on full load and normal B.H.P.

and

$\left(\frac{W}{S}\right)$ = wing loading, based on full load.

The aeronautical engineer often has occasion to estimate the absolute ceiling of an aeroplane for which a detailed performance calculation is out of the question. In such cases it is customary to use either empirical performance charts of formulæ. The performance charts which are given in several of the recent works on aerodynamics and performance are satisfactory so long as the aeroplane under consideration does not depart too far from the average in its characteristics. The formulæ, with one exception, are no better. This exception is developed by Kann in Technische Berichte 1-6 and is of the form

$$H = C_1 \log_{10} \frac{C \dfrac{C_L^3}{C_D^2} \pi^3}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)} \qquad (1)$$

where

H = absolute ceiling

π = propeller efficiency

$\left(\frac{W}{HP}\right)$ = power loading $\left(\frac{\text{gross load}}{\text{normal BHP}}\right)$

$\left(\frac{W}{S}\right)$ = wing loading $\left(\frac{\text{gross load}}{\text{wing aera}}\right)$

C_L = absolute lift coefficient

C_D = absolute drag coefficient

C_1 & C_2 = constants.

The chief criticism of this formula is that it is too complicated for extensive use.

Experience has shown that the terms $\left(\frac{C_L^3}{C_D^2}\right)$ and π^2 may be neglected without seriously affecting the results given by the formula. That is, we may write

$$H = K_1 \log_{10} \frac{K_2}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)} \qquad (2)$$

and determine appropriate values of the constants K_1 and K_2 by calculation or from reliable performance data. Obviously K may be arbitrarily assigned any value which will cause the term within the brackets to assume a reasonable value.

K has been determined for a number of

The average value of $\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)$ is of the order of 1000 and it is desirable that the log term be about unity.

$$K_2 = 10000 \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

fulfils this reqnirement and the formula may be written:

$$H = K \log_{10} \frac{10000}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)} \ldots\ldots\ldots\ldots\ldots\ldots (2a)$$

aeroplanes of all types and is found to have an average value of 19000 with individual values ranging from 17500 to 21000. In most cases, however, the value is quite close to 19000 as shown by Table 1, which contains a few representative determinations of K.

(*Concluded on page* 571)

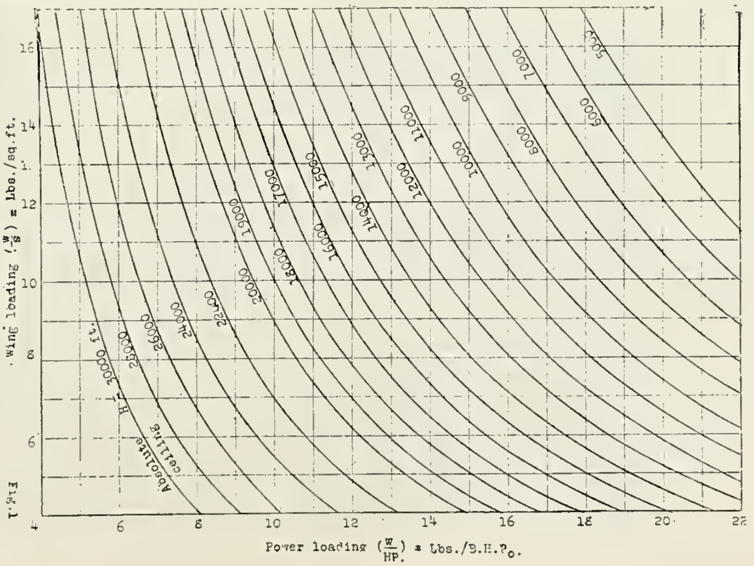


Fig. 1

Torpedo Planes Hit Atlantic Fleet

ON the morning of Wednesday Atlantic Fleet, consisting of September 28, 1922, the three battleships, the *Wyoming*, *Arkansas* and *North Dakota*, were approximately fifty miles off the Virginia capes, in company with a squadron of destroyers to the number of approximately thirty, airplane torpedo and bombing squadron No. 1 of twenty 'planes the C7 Navy airships, and a number of pursuit craft, for the first maneuver ever held in which torpedo-carrying airplanes operated against ships. Eighteen of the twenty 'planes carried torpedoes while the other two carried the commanding officers of the squadron.

Preparations had been made for the scouting 'planes of the Atlantic Fleet, twelve in number, to accompany the torpedo planes in their flight through the capes from the Naval Air Station at Hampton Roads to sea in the attack against the battleships. The C7 airship from the Hampton Roads Station also took part in the maneuvers. In addition, there were naval planes from Washington carrying officials from the Navy's Bureau of Aeronautics for observation purposes.

About 9.30 in the morning, the torpedo 'planes left the beach and proceeded to sea in formation. When the first 'planes were sighted by the ships, the fleet was headed about due East, and rapidly overhauled by the attacking 'planes. The first attack was made at 10.18 a. m. The battleships were maneuvering at high speed to keep the 'planes astern but the squadron of aircraft divided and attacked from both flanks. The *Arkansas,* the target ship and the one on which the Press and officials were carried, sustained seven hits out of 17 shots fired, all close aboard. *that did not hit ran* close oboard. The eighteenth torpedo was not discharged, and was carried back to the base.

The 'planes flew to within about a thousand yards of the ship, dove from an altitude of about 500 feet to within a few feet of the surface of the water, dropped their loads and then zoomed up and away to avoid theoretical raking fire from the decks of the ships.

The dreadnaught depended only on the skill of their navigating officers and their rudders in their efforts to avoid theoretical destruction by the torpedoes launched by the attacking squadron.

The fleet was supposed to be approximately due east of Cape Henry, at a distance of about fifty miles, the definite location being determined by observation of the airship C7 hovering over the fleet and the smoke which was discernible for twenty miles.

The scouting 'planes went out principally to render assistance to the torpedo 'planes should they chance to get into difficulties and to aid in the recovery of the torpedoes after they had been fired. All torpedoes that were fired worked perfectly.

Radio or other signals between aircraft or between the ships and the aircraft were not used in the trial. The 'planes used are known as the PT type, 2-seater, and are old as to type.

The characteristics of the PT 2 (two-seater torpedo plane) are as follows:

Power plt.—Libty. 400 h.p.		
Weight empty		4475 lbs.
Useful load		
Crew, 2	360 lbs.	
Gasoline	483 lbs.	
Equipment	30 lbs.	
Ordnance	1707 lbs.	2580
Total weight		7055 lbs.

Per cent Useful Load 36.5; lbs./sq. ft. 8.8; lbs./h.p. 17.6; 112 gal. gas; 10 gals. oil; endurance full load 2 hrs; cruising endurance 3 hrs; wing curve RAF 6; chord 6' 3"; gap 7' 7½" in front, 7' 5" rear; height 16' 7½"; stagger O; dihedral 2 deg.; backsweep O; angle incidence, upper 5½ deg., lower 4 deg.; float tread 13'2 3/16"; armament torpedo and 1. Lewis.

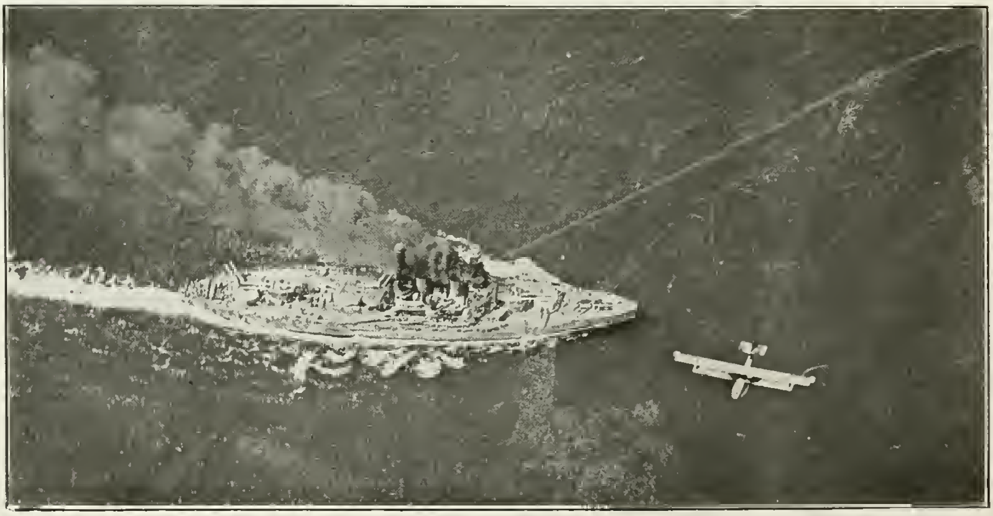
Surface areas as follows: wings, inc. ailerons 808.5 sq. ft.; ailerons 105.4 sq. ft.; stabilizers 54.8 sq. ft.; elevators 45.6 sq. ft.; fin 13.2 sq. ft.; non-skids 17 sq. ft.; rudded 23.8 sq. ft.

Performance: 85 m.p.h., climb to 2000 ft. in 11 mins., and to 3000 ft. in 19 mins.

This plane was designed and built in the Naval Aircraft Factory at Philadelphia.

The PT1 is similar save that it is a 1-seater and the weight empty and the useful load is slightly less.

The Navy Bureau of Aeronautics has been working along consistent lines for the past year in the development of suitable torpedo planes for speed, maneuverability and distance. This work was carried out in recent tests at Anacostia air station of dif-



Showing the wake of a torpedo dropped from a plane in the recent naval maneuvres. A hit was registered

ferent types, the Blackburn "Swift", the Fokker and the American-designed Davis-Douglas, which proved its superiority and has been placed into production. These planes will be in the fleet early in the coming year.

650 H. P. Torpedo Craft

There is still further development work going on looking to the 1923 building program in which a new engine of 650 horsepower is to be incorporated in a new torpedo scouting and bombing 'plane. This engine is making its first appearance in the Pulitzer race in the "NW" or Navy-Wright 'plane, which has been especially constructed around this engine. The Pulitzer race is being taken advantage of for test. This engine expresses the highest development in power/weight ratio that has yet been evolved in aircraft so far as is known to the experts in the Bureau of Aeronautics. In order to place this plane and engine in the race and secure a test under such severe conditions, the manufacturers have been working at top speed to rush this 'plane through, to the end that they have shipped the machine to Detroit where it will be assembled and flown.

An entirely new torpedo scouting and bombing plane will be built around this engine if results are as expected for the future service work.

The racing 'plane has a spread of 30 ft. 6 ins. for the top wing, 17 feet for the lower, and incorporates all the features known in streamlining. The wheels are streamlined and enclosed in "pantaloons" and all wires are streamlined.

In a despatch to the Commander in Chief of the Atlantic Fleet the Secretary of the Navy speaking for the Navy Department expressed appreciation of the excellent results that were obtained from the torpedo plane practice held off the Virginia Capes.

Secretary Denby in his message to the Admiral emphasized the fact that the successful maneuvers conducted with torpedo planes and battleships was a high tribute to the efficiency of the Fleet organization and showed that Naval Aviation was being developed along sound constructive lines as strong and aggressive arm of the Fleet.

The Secretary's despatch read:

"Reports from the Commander-in-Chief and returning observers indicate that the torpedo plane practice completed off the Capes was well executed and that the maneuvers both by the planes in attacking and the battleships in avoiding attack demonstrated a high state of efficiency. The one hundred per cent performance of the torpedoes was most gratifying and creditable. The participation of forty planes and one dirigible and their prompt return to their bases after maneuvers seventy miles off the coast indicates the excellent condition of these forces. The Department is well pleased with the results of this practice and the advancement in the tactical use of the fleet torpedo planes that it demonstrated.

Report of International Conference on Standardized Airship Fittings and Operation

THE report of the international conference held at Australia House, London, February 14 to 17, 1922, to consider the question of standardizing certain airship fittings and operation, has just been made.

This conference was attended by the following: *British Empire,*— A. H. Ashbolt, Agent General for Tasmania, Tasmania, R. A. F., Chairman, and Major Scott, A. F. C., *France*—Captain Sable, Air Attache, and Lieut. de Vaisseau Joughland; *Germany*—Major Stelling, of Parseval Airship Co., anad Commander Herrara, of the Zeppelin interests; *Italy*—Major Graziani, Air Attache; *Russia*—Mr. Akasheff; *Spain*—Commander Herrera, managing director of the Spanish Argentine Co.; *U. S. A.*—Major H. C. Geiger, U. S. Army, Commander Dyer of the Navy, and Mr. E. Wellington Butt, representing commercial interests; *Hon. Sec.*—Commander F. L. M. Boothby.

In addition to the countries represented by delegates, Japan, Switzerland and Czecho Slovakia intimated their acceptance of the principle and asked for copies of the report.

It is called to the attention that the meeting was a strictly private one of experts of different nationalities to consider and discuss matters of common interest in airship communications.

It was the unanimous opinion of the conference that the following resolutions should be accepted by the nationalities concerned and that all airships and airship stations built for international purposes should make provision for these recommendations:

1. "The principle of standardization is accepted.
2. "Standardization means such an arrangement as permits the airships of one nation to use the landing, mooring, gassing and refueling arrangements of any other nation.
3. "Each country retains for itself the right to receive airships by either or all of the following methods:
    At air sheds
    By mooring on the ground
    On water
    By 3-wire mooring arrangements
    By mooring masts.
4. "When airships are landing at shed, on the ground, or on the water, that all trail ropes, pulley blocks used in connection therewith and handling guys be standardized.
5. "Any country adopting the principle of mooring to masts, shall provide that such masts and ships be provided with standardized couplings, water, petrol and gas connections.
6. "This Committee recommends to the next international air conference the formation of a committee to determine the airworthiness of airships. It is recognized that the conditions of airship travel vary according to route and season of the year, consequently the impossibility of laying down a definite margin of fuel and ballast to be carried. The situation can best be met by a formation of a small permanent committee to determine margins for each route according to its merits.
7. "Each country be asked to create an official register of airships in which will be listed all airships and air stations indicating such airships and air stations as comply with the 'international standards' hereinafter arranged.
8. "Pending the decision of the Commission Internationale de Navigation Aérienne, it is resolved that the Council of the Aeronautical Society of London be asked to permit their secretary to receive correspondence referring to 'international standards' and, if desirable, to authorize him t oconvene a further conference. In such event, invitations will be forwarded to the countries interested through the air attaches of the embassies in London.
9. "Lloyds and insurance companies in different countries be informed of the resolutions and standards adopted by the Conference with a suggestion that such standards be adopted by Lloyds and insurance companies as the basis upon which minimum rates of insurance will be fixed.

Standards

10. "The metric system of measurement be adopted.

11. "All rigid, semi-rigid and non-rigid airships over 15,000 cubic meters capacity be required to carry:
    - a—A trail rope of not less than half the length of the ship with a minimum of 100 meters.
    - b—The forward side guy ropes to be such a length as to reach not less than 40 meters below the lowest point of the airship.
    - c—Eyes to which other guy ropes can be secured.
    - d—Some method of hauling down the stern.
12. "Air stations are required to provide:
    - a—A landing block capable of taking the largest trail ropes carried by an airship.
    - b—Side guys and toggles suitable for airships of any size.
13. "All gas, fuel, water and oil coupling pipes shall be fitted with 'international' right handed threads.
14. "In addition to facilities provided in sheds for refueling airships similar facilities should also be available on the landing grounds.
15. "This Conference recommends the following sizes as most suitable for the flexible connection between airships and mooring masts or air stations.

    Gas connections, inside measurement—300 millimeters

    Water connection, inside measurement— 75 millimeters

    Fuel connection, inside measurement— 40 millimeters

    Airships containing pipes of dimensions other than those indicated to have such arrangements installed as will enable their pipes to connect up with the standards recommended herein.
16. "Air stations are to be fitted with female connections, airships with male connections.
17. "Airships designed for mooring to mast must carry a cone gimballed on to the ship and rotating on its own axis. The size and shape of such cone to be that shown on the attached drawing. The wires passing through such cone shall not exceed a diameter of 18 mm. Such landing wire must be fitted at the outboard end with a splice, the eye of which shall be 230 mm. long, also as shown on attached drawing.
18. "The mooring mast station must provide similar rope fitted with a quick coupling to take a loop at the outboard end of the trailing rope. The mast must be fitted to take the rope (up to 18 mm. diam.) together with the necessary coupling.
19. "Suggested signals for mast mooring.

    At stations
    At Day
    At Night and in Fog

    The position of the mast mooring wire will be indicated by
    A White Patch
    A White Light Waved

    When the mooring wire ropes have been secured, the ground will signal the airship by
    Waving a White Flag
    A White Light Flashed

    When the airship is ready to haul down the ship will indicate by
    A Green Flag
    A Green Light

    To stop hauling the ship will indicate by
    A Red Flag
    A Red Light

    To ease away the ship will indicate by
    Red and Green Flags shown together
    Red and Green lights shown together
20. "The standards arrived at remain in force for two years when the whole question can be considered in the light of further experience then gained. If at any time, any important development occurs or fresh inventions, or if by practical experience standards adopted are found dangerous, the Committee will immediately be convened to establish fresh standards.
21. "A hearty vote of thanks be passed to Sir Joseph Cook, the High Commissioner for Australia, in granting the use of the rooms for the conference."

It is unfortunate that there exists in the United States and in Germany, and to a lesser degree, in England and France, no national agency empowered to put into force any such regulations as these or other that may be no matter how advantageous for the advancement of navigation.

For the present, it seems, that there can be maintained by the Army and Navy of respective countries lists of airships and airship stations, with data thereon, for the information of other countries and agreements arrived at unofficially.

In the matter of mooring masts, the art is still exceedingly young and many and varied are the designs extant. It has been possible, it will be noted, to confine restrictions as to these to but a minimum of items.

Curtiss Model D-12 Aeronautical Engine

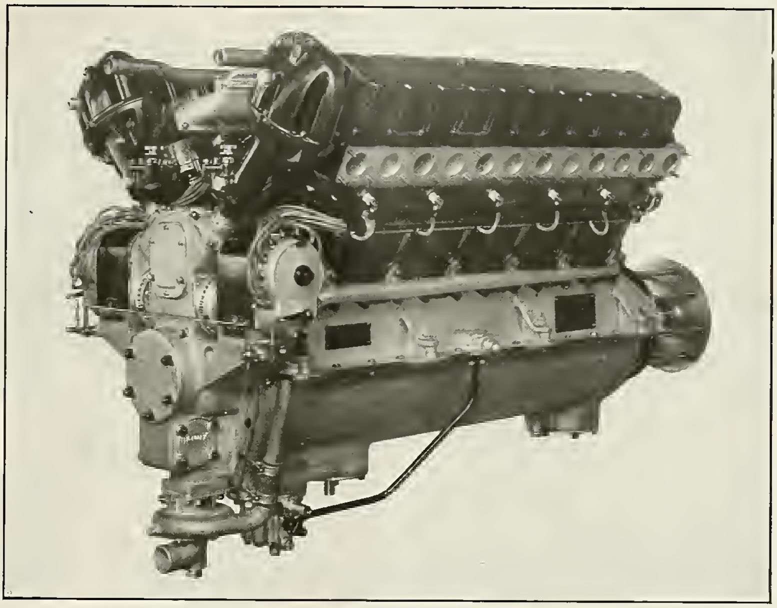
THE Curtiss model D-12 engine is a development from the Curtiss model CD-12 engine of the same bore and stroke. After exhaustive tests on the model CD-12 it was decided to entirely rebuild the engine to decrease the weight if possible, increase the reliability if possible and improve the present fine accessability. The seven-bearing crankshaft was retained as well as the well known use of main bearing caps on the crank-case. The distribution of the bearing areas on the main journals was changed to conform with Air Service requirements. This change necessitated the making of entirely new patterns and forging dies for all the main parts of the engine. A careful study was made of each individual part on the engine during this redesigning in order to save weight as well as increase the strength if possible. The details of changes in the various parts of the engine are outlined below. The result of this redesign was an engine weighing 35 pounds less than the model CD-12 developing 10 to 15 horse power more at the same speed.

The Curtiss D-12 engine of the 60 degree Vee type consists of two rows of six cylinders en bloc having a bore of four and one half inches and a stroke of six inches with a total displacement of 1145 cubic inches. The engine is of the aluminum cylinder type with inserted steel sleeves in contact directly with the cooling water. The engine uses two overhead camshafts per cylinder head driven through bevel gearing and operating four valves per cylinder.

Cylinder Head Construction.

The same cylinder head construction as used in the CD-12 engine has been retained. Steel cylinder sleeves of carbon steel hyrdaulically forged with one end closed are rough machined, heat-treated and then finished machined before assembling in the cylinder head with the exception of the final grinding of the bore. The threaded portion of the sleeve is approximately one and one half inches long at the upper end. Careful machining is done on these sleeves and the cylinder head to maintain a perfect joint between the aluminum head and the steel sleeve. An integral stud on the end of the closed head of the sleeve passes through the water jacket thereby improving the contact between the steel head and the aluminum head. The valve port holes are machined after the sleeve is assembled. Spark plug bushings are also assembled after the sleeve is in place, duralumin bushings being used in place of brass as was former practice. The aluminum water jacket which is cast in one piece for six cylinders is assembled over the lower end of the six sleeves, the water joint being maintained between the sleeve and jacket by a composition gasket under the flange on the sleeve. The upper joint is made tight with a copper asbestos gasket. The sleeves fit very snugly in the water jacket at the lower end which gives them ample support to prevent the thin sleeve from going out of round.

Reduction in valve size of .040 inches was found necessary to make the valves removable from the cylinder without removing the valve guides. This slight decrease in valve size had no effect on the power since the power is actually higher in this new engine than in the CD-12 engine.



Magneto end view of the Curtiss CD-12 Aero Engine

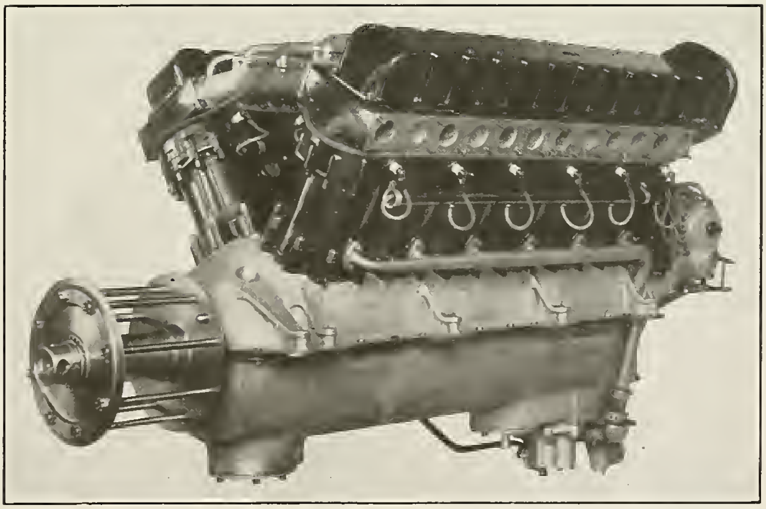
Valve Mechanism.

Each cylinder is fitted with four steel tulip valves, two intake and two exhaust which are interchangeable. These valves seat directly in the steel cylinder head as in former practice. The camshafts are mounted on the top of the cylinder heads on six aluminum brackets, the shafts running directly in the aluminum. These brackets are carefully dowelled to the head and are interchangeable, no alignment, reaming or hand scraping being necessary during manufacture or overhaul. The intake camshaft is driven by the exhaust shaft thru spur gears at the anti-propeller end. A bevel gear is mounted on the exhause camshaft in a novel way. The spur gear on the exhaust shaft is extended beyond the width of the normal gear and the bevel gear is internally splined with a Fellows gear shaper to fit over this extension. A single large flanged nut holds this gear on the shaft. Owing to the fact that the number of teeth on the spur gear differs from the number of teeth in the bevel gear a very fine adjustment is obtainable on the timing by shifting the gear in relation to the shaft.

One cam operates two valves through a Tee shaped tappet working in a bushed hole in the cylinder head. This tappet has been redesigned to increase its strength, reduce wear and facilitate production. This type of tappet removes all side thrust from valve stems. The valves are adjusted as before by adjusting screws clamped in the ends of the Tee tappet. The camshaft bearings are lubricated by oil pressure of approximately 10 pounds per square inch and the Tee tappets and valve guides are oiled by splash.

Crankshafts

The crankshaft is one of the conventional seven-bearing type being made of low chrome nickel steel. The crankshaft has been redesigned to take care of the redistribution of the main bearings, the center bearing being 1¾ inches effective length and the balance of the bearing 1-½ inches thereby doing away with the three 1" bearings used in the CD-12 engine making larger bearing surfaces and decreasing manufacturing costs. The same journals and crank pin sizes of 3 inches and 2½ inches respectively have been retained. The crank cheeks have been made oval instead of rectangular increasing the width ¼ inch and decreasing the weight of the crankshaft at same time giving a stronger and lighter shaft. The same type of propeller thrust bearing is used on this engine mounted between No. 7 and 8 main bearings, namely, a deep-grooved radial annular ball bearing. This



Propeller end view of the Curtiss CD-12 Aero Engine bearing takes thrust in either direction and the method of mounting adds greatly to the rigidity of the propeller in flight and gyroscopic forces are well taken care of by this arrangement.

Crankcase

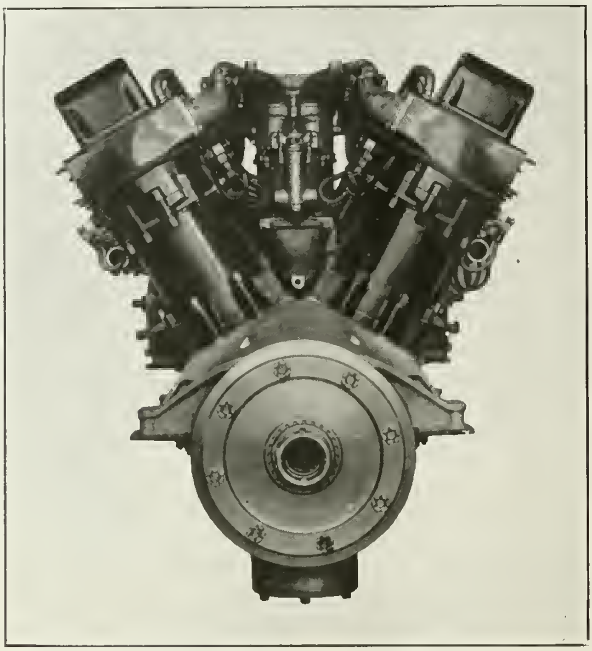
The upper half crankcase cast from an aluminum alloy is practically the same as on the CD-12 with the exception that the nose has been shortened after removing the propeller and electric started bosses. The cast aluminum main bearing caps have been replaced by duralumin forgings having four times the strength for the same weight. Each cap is carefully keyed to the crankcase to prevent it from shifting during operation.

Bronze backed babbitt-lined bearing shells are used, held in place by countersunk head brass screws. The babbitt bearings are bored to size in a boring mill, thereby maintaining the clearances in all bearings the same and insuring perfect alignment.

Accessory Drive Shaft and Gearcase

On the anti-propeller end of the engine is mounted a typical gear-case as used on this type of Curtiss engine. The gearcase has been redesigned to provide better accessibility and to make provision for mounting of the Air Service gear gasoline pump as well as gun generator drives. The use of this type of gearcase facilitates production and permits lighter weight. As used in the CD-12 engine all shafts and gears are assembled using stub-tooth teeth as splines. Altho the engine has a 60 degree angle between cylinder banks, the vertical drive shaft is brought to a height where 90 degiee drive shafts run directly to the bevel gears on the exhaust camshafts. The tachometer drive has been removed from the vertical shaft which runs 1½ crankshaft speed and has been taken off of the left hand exhaust camshaft thereby simplifying the design and making the drive more accessible. All gears have stub teeth.

A very satisfactory magneto coupling drive has been developed for the D-12 engine. This drive consists of a combination of an Oldham coupling and thermoid disc with a micrometer adjustment obtained by the use of a series of holes of different total number in two discs. The Oldham coupling takes care of all offset and thermoid disc takes care of angular misalignment as well as protecting the magneto from gear shocks.



End view of the Curtiss CD-12 Aero Engine

The water pump design has been changed to provide a ball bearing in the water pump in place of a plain bearing and a splined shaft drive in place of the squared coupling formerly used. Adequate glands have been provided to prevent both oil and water leakages. An Alemite connection is used on the water gland to keep the packing lubricated to prevent leakage. The lower vertical drive shaft is designed to drive the Curtiss triplex plunger gasoline pump in Army Air service gear pump the upper end of the upper vertical shaft is indirectly splined for a Liberty generator. The gear-case is provided with a boss to take the Bijur anti-propeller end starter.

Pistons

The same type of piston is used as in the CD-12 engine, being the ribbed head type, which gives a light weight piston of considerable strength. The rings have been lowered to provide a wider top land and to make the rings all the same width, namely, 3-32.

The piston pins float in the pistons and connecting rods being held in place by means of piano wire snap rings. There has been no change in the connecting rod assembly, this being the articulated type, the short rod being forked over a boss on the master rod. Non-gran bushings are used for the wrist pins and piston pins.

Lower Half Crankcase

The lower crankcase has been entirely redesigned to eliminate the oil tank which was formerly built into the engine. The oil pump was also redesigned, three separate pumps being used instead of the three gear suction pumps and the two gear pressure pumps. By this means weight was saved and the drive of the pump was greatly simplified. The oil pump is driven from the lower vertical shaft in the gearcase thru spur gearing, a team of three gears being used. The middle gear is adjustable to obtain the proper gear back lash without necessitating careful machining for center distance.

Carburetion

At the present time the engine is fitted with two Zenith U. S. 54 carburetors which have beeen rebuilt to provide parallel throttles and an improved mixture control. These changes with the proper carburetor setting has given an extremely flexible engine coupled with wonderful acceleration without sacrificing maximum power. The two carburetors are inter-connected with a cast aluminum air duct, which obtains its air through a sheet aluminum air stack from outside of the airplane body.

Ignition

Two single spark 12 cylinder Splitdorf magnetos model SS12 are used for ignition on the engine feeding two spark plugs per cylinder placed diametrically opposite. One magneto is wired to the exhaust plugs and the other to the intake plug. The use of these magnetos has resulted in the saving of over six pounds total weight without a sacrifice of performance or reliability.

Cooling System

The cooling system had only a few slight changes. The pump has been redesigned as stated above, the double shrouded type of impeller being retained. The capacity of the pump has been increased slightly. As before the pump delivers water thru a distributing manifold on the lower end of each cylinder block, discharging at the top into another manifold.

This engine has been designed to use water manifolds for the outlet directly on the cylinder head thereby eliminating the objectionable feature of passing water thru the intake manifold gasketed joint.

Lubricating System

The conventional Curtiss lubricating system is used on this engine, being refined to such a degree that a consumption of .015 pounds per B. H. P. per hour may be used as an average figure for continuous flying. Minimum figures of one half this value have been obtained in block testing. The scavenging pumps, which are now entirely separate eliminate any chance of air entering the system and thereby destroying the pump capacity. These scavenging pumps have been increased fifty per cent in capacity. All plain bearings in the gearcase are pressure fed with the exception of the lower vertical shaft which runs in a bath of oil. All other bearings are splash fed by the oil running back from the camshafts which are carefully housed in with an oil tight housing.

Propeller Hub

The propeller hub has been redesigned so that standard Liberty bolt size and bolt circle are used. A novel use of duralumin has been made by the use of this material in the loose flange.

Gasoline System

The gasoline system used on the high speed airplanes using the D-12 engine consists of the Curtiss triplex gasoline pump feeding gasoline directly to the carburetor, an overflow being provided from this pump to take care of the over capacity of the pump. The gasoline is fed with a relief valve to maintain a constant pressure. This type of pump gives positive priming and unusual reliability since the pump is oiled under pressure against leakage past the pistons and the speed of 325 r. p. m. is very low.

Summary

With the above changes, an engine has been obtained weighing 670 pounds without water and delivering 400 B. H. P. at its normal speed of 2000 r. p. m. By the use of higher compression ratios and doped fuel as well as higher speeds this power is materially increased so that the result is an engine which develops a minimum of 430 horse power at 2100 r. p. m. The engine has been submitted to a Navy 50 hour test showing very good performance and other tests are now being conducted during the production of more engines.

The B. M. E. P. obtained in this compact engine are as high at 2000 and 2200 r. p. m. as obtained usually in an engine running at 1800 r. p. m. The Curtiss D-12 engine represents more nearly the ideal airplane engine than any other motor owing to its light weight and low head resistance per horse power which allows the engine to operate at light power having a tremendous reserve power for emergency coupled with reliable operation at full power.

Uppercu, President of the A. C. C. One of America's Most Enthusiastic Supporters of Aviation

IN the election of Inglis M. Uppercu as president of the Aeronautical Chamber of Commerce, a pioneer in American aviation, who has hitherto remained comparatively little known, come prominently to the front. He is unique in the automotive world, in that he has for years been one of the most successful distributors of motor cars, and as such is a powerful figure in the automobile business, while throughout a long period he has consistently devoted a considerable portion of his income to the development of flying.

The aircraft industry is probably the most talked of industry in the country today. Hardly a group of business men assembles without a discussion of aeronautics. Yet, as Mr. Uppercu once phrased it: "If you passed the hat you wouldn't get a nickel." The difference between the new head of the Aeronautical Chamber of Commerce and many of the talkers is that Mr. Uppercu backs up what he says. First and last, in the past twenty years, he has invested nearly $30,000,000 in aviation, first in experimenting and later in scientific research and the practical operation of aircraft.

Mr. Uppercu was born in North Evanston, Ill. As far back as he can remember kite flying held him fascinated. When he was a little boy his parents moved to Montana and there, in the winds that frequently swept the hills and high plateaus of his father's sheep ranch, Inglis had opportunity to test new kites and to dream, like so many others have dreamt, of following the eagles in their swift strong flight. His Grandfather Hildebrand loved kites, too, and together the old man and the little boy would construct new devices for the air. Whenever the father took Inglis on even the shortest trip from home, the lad, on his return, would invariably find Grandfather Hildebrand with a new kite sailing high to welcome him back.

As he learned to read, Inglis obtained a set of books called "Science For All" and the flying and balloon sections of these, meager enough at that time, he learned almost by heart. So convinced did he become that it would be possible for him to fly that, when about 5 years old, he built a "flying machine." A cracker box was the fuselage and the first wings were made like kites, but they appeared too flimsy. So the boy obtained a pair of eagle's wings and tacked them on. With his sister, a few months older, he held many conferences as to the time they would be gone, where they should go —the provisions they should take. At last, one night, when, in the clear air, the brilliant stars came close enough to reach, Inglis and his sister dragged their "airplane" to the roof of the shack, and were about to "take off" when their father interfered.

The next stage came several years later. The family were living in St. Louis. Next door was the home of a mechanical experimenter who was later to make a name in the automobile industry—Chas. E. Duryea. Mr. Duryea's immediate problem—it was in 1886 or '87—was to make the primitive high wheel bicycle safer. But he and the youth use to talk about flying and Mr. Duryea made many models which sustained the youth's interest and hope. Mr. Duryea soon went to live in Washington and the Uppercus to New York. On one of Mr. Uppercu's visits to Washington, Mr. Duryea said: "Inglis, you and I will have to get a 40-acre lot and build a flying machine factory in the middle of it."

About 1890 Mr. Duryea had his work on the internal combustion engine well under way and gave Mr. Uppercu his first job. In 1901 or 1902 (the very time Langley and the Wrights were experimenting) Mr. Duryea built a 50 h. p. 3 cylinder airplane motor which weighed but three pounds, per horsepower, remarkably light considering the knowledge of the period. Mr. Uppercu's association with Mr. Duryea gratified the boy's ambition to work with "moving things" and Mr. Duryea's interest in flexing undoubtedly led Mr. Uppercu some years later, when the automobile business had enabled him to lay the foundation of a fortune, to give substantial aid to aeronautical research.

In 1908 Frank Boland of Rahway, N. J. built a tailless airplane that flew successfully many times. It was with Mr. Uppercu's help that Mr. Boland made his early experiments and it was with Boland, in the fall of 1908, that Uppercu took his first flight. What the boy, on the Montana plateaus, instinctively *believed* about the air, the man, now actually *felt*. The air was not simply an invisible, entangible, ether; it was substance; it was stable; it was capable of supporting a man and a machine. The old Boland aircraft, crude as it was, has a distinct place in the progressive line which is manifest today in the planes and boats built by the Uppercu interests.

The investment of a few hundred dollars in 1908 was consistently increased and small plane and motor plants were built under Mr. Uppercu's patronage, first at Newark, then at Nutley and finally at Keyport, N. J. The firm was originally known as the Boland Airplane Co. In March 1914 it was desired to re-incorporate and it was Mr. Uppercu's aim to provide an expressive, descriptive name. He had the example of his automobile business. In 1902, when it became apparent that automotive transportation had before it a great popular future, Mr. Uppercu incorporated under the name of "Motor Car Company of New Jersey." So far as there is record, it is declared that this was the first notable use of the term and his friends credit Mr. Uppercu with actually having originated it. The aircraft company, in 1914 was well along in the development of marine flying craft. Mr. Uppercu then coined the word "Aeromarine" which has since become known the world over. The Aeromarine Plane and Motor Company thus came legally into being.

From 1908, when he flew numbers of times with Mr. Boland, Mr. Uppercu had not, up to the fall of 1917, been in the air. It so happened that his reintroduction to flying came through a naval pilot whose idea of aviation was to scare his passengers and then pose as a hero engaged in a desperate occupation.

"When we alighted," said Mr. Uppercu, "I thought, 'If this is flying, it is folly to attempt to commercialize it.' So he set about learning the truth. He picked his own pilots and from that time on the word "Aeromarine" became synonymous with safety and sanity. "I had first to sell flying to myself," said Mr Uppercu, "before I could hope to sell it to others." So he learned to fly.

In the five years that have elapsed since that experience, Mr. Uppercu's operating company, Aeromarine Airways, has flown hundreds of thousands of miles transporting many thousands of passengers in comfort and security. He has established lines between Key West and Havana, New York and Atlantic City and Cleveland and Detroit. These services were the first in the United States and to date are the only ones maintained on schedule. The manufacturing corporation, the Aeromarine Plane and Motor Company has greatly expanded in the last few years and at present is engaged on War, Navy and Air Mail contracts aggregating one and a half million dollars.

Mr. Uppercu's chief automobile interest is the Cadillac Motor Car Company of New York, of which he is President.

The Silencing of Aircraft

THE muffler on an automobile is a requirement of law. It is natural to suppose that aircraft will be required to meet similar conditions the moment flying noise becomes a nuisance and this is only a matter of time when the volume of air traffic is sufficiently great. Legislation will eventually force aircraft muffling, even if the obvious advantages remain unheeded.

Military and Naval

The good results of silencing are obvious. These are set forth.

As airplanes, for example, can be heard from a great distance, long before they can be seen, listening devices which show location and distance enable the enemy to be forewarned and prepared. By muffling, machines can get nearer the enemy before being perceived and carry out their work at a lower altitude and with greater surety. At night, the advantage is probably increased.

The pilot and observer can carry on conversation without the use of signals or telephones.

By the use of a cut-out, signals can be made from one machine to another in formation flying. Signals may be made to the aerodrome.

The noise of the engine is an obstacle in radio communication.

The noise of an unmuffled engine has an undesirable effect on the pilot's system.

Though no regulations in the U. S. have thus far been made, it is obvious that aircraft will have to be muffled just the same as have motor boats and automobiles. Because of this novelty of aircraft, have they escaped prohibition of noise.

Passengers will want to converse during flight.

The continual roar of an engine is objectionable to the ears of paying guests. Every other method of transportation strives to afford the utmost in convenience and comfort.

The Noise of Flight

The noise caused by an airplane arises chiefly from two sources. These are: 1st, the noise of the exhaust gas leaving the engine. 2nd, the whirr of the propeller. Since the noise of the engine is much greater than that of the propeller, if we can deaden it, or do away with it altogether, we have done, perhaps, all that is necessary.

From a military point of view, it is necessary for the machine to fly absolutely without noise, either from the engine or from the propeller. The simplest method of reducing the noise of the propeller is to reduce its speed of rotation. The usual type of propeller revolves at 1400 to 1800 r. p. m. Besides the inconvenience caused by the noise, this speed has the disadvantage of causing considerable loss of propeller efficiency. In order to avoid this double inconvenience, many aviation factories, especially in England, have long made engines with special gearing, reducing the speed to between 700 and 900 r. p. m. In most cases these engines are fitted with four-bladed propellers. This arrangement allows of reducing their dimensions, increasing the efficiency, and reducing the danger of breakage. The resulting lessening of noise is not perceptible, however, on account of the all-dominating intensity of the noise of the escaping exhaust gas.

It has, however, been proved that during a glide the noise is no longer audible from the ground, even when the machine is at an altitude of but 500 to 700 meters and the propeller is turning at 500 to 700 r. p. m. There is thus no doubt that the combined use of a geared propeller and a silencer adapted to the engine provides an almost perfect solution of the problem of the silent airplane.

The noise of the engine is caused by the energy of the exhaust gas which leaves the cylinder at great speed, with a considerable amount of heat, and at a presure of 5 to 7 atmospheres. The silencers used in automobiles are built on the principle of the discharge of the exhaust gas into voluminous manifolds in which the gas is forced to change its direction frequently, which tends to a reduction of speed. This method of deadening the sound has several technical defects of which the following are the chief: great volume, considerable weight, great resistance to escape and consequent loss of power in the engine caused by back pressure. Increasing exhaust resistance also causes over-heating of the cylinder walls. The silencer now used in automobiles causes a greater quantity of exhaust gas to remain in the cylinder after the stroke of the piston, the temperature of compression to be higher, combustion to be incomplete on account of the unfavorable composition of the gaseous mixture, the gasoline to mix in the cylinder with too much exhaust gas and the fouling of spark plugs and valves.

In Switzerland, where the authorities banned flying entirely near Lucerne until engines were muffled there has been developed the "Ad Astra" silencer, a note on which was published in *Aerial Age* of January 2, 1922. An observer reported: "There was scarcely any noise from the airplane during flight. At an altitude of 1000 m. only the propeller was heard. Other machines were up at the same time, and the difference between them and the one fitted with the silencer was striking. According to the date given by those checking the tests, there was neither loss of engine power, nor greater heating. It was even found that there was economy of fuel. The silencer can easily be placed in a suitable housing on the 'plane so that there will be no increase in head resistance."

This speaks in behalf of the airplane, with usually but 300 or 400 horsepower. One may well think of the airship—there is the ZRI of the Navy with six 300 h. p. engines—and its increase in volume of noise.

The requirements of a muffler may be summed up as follows:

There should be no objectionable loss of power. In tests of certain mufflers by the University of Michigan a loss of less than 1 per cent was shown.

There should be a saving of fuel.

Better cooling of cylinder walls should be obtained.

Cleanliness of spark plugs and valves.

Exhaust gas should be thoroughly cooled as it leaves to avoid the present danger of fire.

The muffler must be capable of being easily incorporated in the design of the aircraft.

The weight of the device should not be prohibitive. For 250 horsepower it should not weigh more than 20-25 pounds.

Shape must be favorable for the reduction of head resistance.

Quick detachability is desired.

The more rigid requirements of the aicraft muffler will when met, add much to the pleasure and economy of automobile transportation. An evidence of this benefit is furnished by the tests in 1915 of the University of Michigan in which some commercial automobile mufflers lost 14 to 18 per cent of the engine power. Such loss is expensive as well as needless.

In the matter of mufflers alone, it is evident that the automobile will again benefit by the airplane.

Those concerned in this work will be interested in Reports nos. 10 of 1916 and 55 of 1920, of the National Advisory Committee for Aeronautics, Washington, D. C., which reports cover the only work officially done in mufflers in this country, so far as is known. In these experiments a 75% reduction in exhaust noise was found certain of easy acquirement.

American Airplane With Change Speed Device

90 Mile Speed Range—Ceiling Increased Over Half—Climbing Speed Raised 31%—A New Era Promised

A device which will add 40 per cent to the high speed, reduce the landing speed by 26 per cent, add 51 per cent to the ceiling and cut 31 per cent from the time of climb to 15,000 feet of the standard airplane is the claim of an American in China, J. J. Dill, whose apparatus may be fitted to any ordinary machine and operates to change the angle of incidence of the wings, at will during flight from zero to 10 degrees.

A series of test flights have recently been made by a military pilot at Harbin of a machine fitted with the Dill device. At a fixed angle of 3½ degrees the average speed was about 94 miles an hour, with a Rhone 110 h. p. engine, despite the fact that the power plant was in bad order. In the second flight exceptional results were had with the device in operation. An altitude of 6560 feet was reached in 4 minutes with an angle of incidence of 6 degrees. During this flight the pilot changed the angle of incidence from 2 to 8 degrees. The corresponding speeds in horizontal flight at 2000 metres (6560 feet) with various angles of incidence, as shown by the speedometer, were as follows:

Angle of 8 degrees, speed 65.62 m. p. h.

Angle of 4 degrees, speed 90.62 m. p. h.

Angle of 2 degrees, speed 103.12 m. p. h.

"The alteration of the angle of incidence in no way affected the control of the rudders, and the variations did not make any pressure on the control stick; and the stability of the machine was in no way affected, having the same aeronautical qualities at the different angles," reads the pilot's report "The landing was easily made in the space of 82 feet with an angle of 6 degrees."

"The invention makes this airplane entirely different from any other I have flown, the difference being: (1) the short run required in starting and landing, (2) the rapid high climbing power, and, most important, (3) the different speeds obtained during horizontal flight, which can be changed at will in wide limits without any change of motive power.

"In my opinion the building of machines with high powered engines of 300 to 600 h. p. and more, and fitted with the Dill invention, will create a new era in aviation and make it possible to get the highest speeds, such as would be impossible without the invention, and with full load allow a machine to successfully take off and land."

The present day airplane, with fixed wings, may be compared with an automobile with powerful engine but with but one speed. An airplane of high horizontal speed must necessarily take off and land at comparatively high speed; and the machine with slow take off and landing is impracticable for military and high speed commercial purposes.

An airplane with a high climbing speed and capable of attaining a great altitude usually must have a powerful engine, or a high angle of incidence. In the first instance, it is expensive and in the second the 'plane must necessarily have a lower horizontal speed. In both cases, the machine has but one horizontal speed for any non-variable wing setting. To beat this situation, the changeable angle of incidence provides a radical solution.

The experiments, which are reported to have covered eight years, with official observation beginning in 1919 at Omsk under a Kolchak government commission and later at Harbin with another machine, are said to prove:

"By means of the Dill invention it is possible to alter during flight the angle of incidence of wings, smoothly and without any strain on the pilot.

"The alteration of the angles does not in any way affect the stability of the machine.

"The mechanism itself has an insignificant weight, and does not affect the strength of the machine.

"For the different angles the strength of the truss remains unimpaired."

The following comparison is made in the report of two airplanes of the same kind and characteristics:

Weight	........2400 lbs.
Power plant	.....300 h.p.
Wing surface	..280 sq. ft.
Profile	.........RAF 15

In this instance one machine is supposed to have no adjustment for altering the angle of incidence and has a fixed angle of 2 degrees. The other is supposed to have the Dill invention attached by which the angle can be altered from 0 to 10 degrees during flight, at will. Comparing the two, a report by an observer of the test flights states the following figures:

SEE COPY FOR TABLE

With the first machine, a biplane 2-seater, with 110 Rhone, the 1919 tests results in the following performance:

Climb to 6560 ft. with full load	10.7 min.
Climb to 14,760 ft.......	48 min.
Take-off distance ..	197 ft. max.
Landing...........	295 ft. max
Speed at 8 deg.......	75 m. p. h.
Speed at 4 deg......	875 m. p. h.
Speed at 0 deg.....	112.5 m. p. h.

The idea of changeable angle of incidence is not new but no practical device has yet been placed on the market. This scheme would be of inestimable value to the air flivver to which we are lookng but which manufacturers are reticent about producing this, and a reversible "prop."

TYPE	High Speed in m. p. h.	Low Speed m. p. h.	Ceiling feet	Time of Climb to 15,000 ft.
Dill machine	160.7	66.7	17,250	13.52
Ordinary machine	114.7	90.	26,080	19.72
Percentage	40%	26%	56%	31%

An American DH4 performance is cited below for purposes of comparison

DH4	124.0	61.5	17,600	40 min.

Flying in California

By R. J. Smith

To those who are contemplating inaugurating an aerial transportation line and have sufficient money, backbone and ability with which to feed it during its infancy, the Pacific coast offers unlimited potentialities. On the other hand, individuals or small companies who are financially weak might more profitably go elsewhere, for California has already many such companies who are "just about making expenses" or, in the language of the individual "free lance," doing "not so good." At the time of writing, most of the last mentioned are "doing the small towns." Eastward, business as a "joy hop merchant" being slow in and around San Francisco, pilots without planes and jobs are plentiful here, too, although most of them, owing to the state law governing aircraft, hold state licenses.

The West today needs and is well able to support, reliable aerial transportation lines, which have, as before stated, sufficient money, backbone and ability behind them to be able to overcome all obstacles which might present themselves the first year, and present and maintain a regular service on schedule between certain cities here. The companies running these lines could safely start with large planes capable of carrying 10 or more passengers each, for in the writer's opinion the introduction and sight of these large aeroplanes would impress the public more favorably than a smaller model; in fact it is doubtful if the latter type would be favored at all. An instance might be quoted here as an example. Recently an organization inaugurated a flying company here in San Francisco. It was advertised that the planes owned by the company would maintain a schedule and fly between Los Angeles and San Francisco. The planes to be used were "Standards" with "Hisso" motors and some were converted to carry four or five passengers, I believe. I have a great respect for both this type of plane and engine, but venture to say that a "Standard" fitted with a "Hisso" motor is hardly a "five place job" or even a four. Needless to add, this company did not succeed here. But bring the large plane, put it on the same route, advertise extensively and sensibly, secure the services of an efficient personnel, a flying manager, one who will keep the planes in the air, let discipline be the company's slogan, and the spirit of esprit-de-corps prevail, and I feel positive success will be the reward. Then from San Francisco to points up the Sacramento River, sea planes or flying boats could be put into profitable service. One might ask how the public would take to it. Whether they would immediately or not is rather hard to say, but I think they would, especially the people of San Francisco. They would, I think, start the ball rolling and then the rest would follow suit. My reason for saying this is because the fliers of Crissy Field, both Air Mail and Army pilots have by their excellent flying shown the public here and for miles around that flying is safe in all weathers. These officers have much to be thanked for by commercial interests, for they have efficiently "paved the way." One sees perfect formations passing over the city and the bay almost every day. They fly at safe altitudes and sanely. I have often heard people remark, "How safe they always look up there." Also there are a good many who judge the time of day by when the mail plane goes out and comes in, so regular is the schedule.

The aeronautical organizations in the East would profit by investigating and taking advantage of the possibilities here.

San Francisco seems to be favored as an ideal city in which to hold conventions. Hundreds of thousands of business officials flock here yearly from all over the United States, and apart from one or two "joy hop" planes, there is no aircraft service to offer them. This year there were over 300,000 "Shriners" in town for their convention. The Army pilots gave them an exhibition of good flying. Capt. Yerex, the British R. A. F. pilot and another whose name I do not know, flew over the town at night giving acrobatic flying displays in an illuminated plane throwing fire, but nothing serious was done in the way of sight-seeing trips. In fact, I think I can safely say not more than 50 (if that) even flew out of the whole 300,000. Let us assume that there had been an organization operating large planes here at the time. They would have reaped a small fortune in sight-seeing trips alone. Another point worth considering is the fact that these Shriners came from all corners of the country and are now "back home" talking about all the excitement they had here. The same thing happens when the men taking part in future conventions return to their home town. An aerial transportation line would therefore receive much invaluable publicity.

The aeroplane is by no means a "new mystery" here. The public have been partially educated that flying is a safe mode of travel and it is good to note that although much flying has been done, accidents, even of the smallest nature, have been very few and even these have mostly, if not all, been due to stunt flying or taking unnecessary risks. The state law forbidding pilots to fly without licenses has, I think, improved matters considerably here. Local interest in San Francisco would, I should say, support an aerial transportation line if approached in a tactful and businesslike way, until the line's development permitted it to be independent of any one source of revenue. Business generally is good here and where business is good so should flying be.

Let us now consider the weather and the characteristics of the ground along certain routes. Unfortunately I have not much data on the latter but this might be easily ascertained from the regular maps and from various other sources. I might say, however, that most of California is good, and although the state is mountainous only a few need be crossed to reach any point. There is generally a fog hanging over San Francisco Bay territory, but if one knows the bay and is careful this is not a serious drawback. The uneven character of the ground makes the air at low altitudes bumpy at times, but taking all in all, it's not a bad old state to fly over, from the pilot's point of view. One can judge the physical hazards here fairly well by reading the description of California in an article entitled "Information for Pilots, Giving the Practical Characteristics of the Land Along Various Routes," which is in the October 10, 1921 issue of AERIAL AGE.

This article gives but an outline of what might be here, and in fact what can be expected in the not very distant future. Much more could be said, but this outline may be of interest to those who read it. It may receive criticism. I hope it does, for that will prove interest, and if my critics will send in their various opinions to AERIAL AGE I have no doubt that the Editor would compile the data received and publish another article which would be based on the facts sent in this way, for such an article would, I feel, be very interesting and helpful to aeronautical interests.

AERIAL AGE

PUBLISHED MONTHLY

Copyright, November, 1922, by THE AERIAL AGE CO., INC.

5942 Grand Central Terminal, New York

VOL. XV NOVEMBER, 1922 No. 19

Detroit

AERONAUTIC history was written at Detroit, and records that are likely to stand for some time were established. Aeronautic enthusiasts rejoice that all of the contests staged were carried through without injury to any of the participants, a very remarkable event when one bears in mind the extraordinary speed which some of the machines attained.

The Curtiss Company created an enviable record by having its four machines take the first four places in the Pulitzer, a worthy testimonial to the efficiency of the Curtiss CD-12 engine, which is completely described in this issue.

Everyone concerned with the management of the Detroit events have every reason to be thoroughly satisfied with the outcome of their efforts.

National Aeronautic Association

The developments which will follow the organization of the National Aeronautic Association are being associated with interest by all interested in the advancement of American Aeronautics. There is much constructive work that requires to be done, and it is to be hoped that this new body will get down to business and endeavor to rehabilitate the sporting and social side of aeronautics, which, at the present, requires much rehabilitation. Details of the formation of the association reached us too late for inclusion in the November issue, but we hope to deal fully with the subject in our December issue.

A Woman Crosses the Continent

To Miss Lillian Gatlin goes the honor and distinction of being the first woman to cross the American Continent by the air route. She was consigned by air mail in San Francisco with her destination New York, which she made successfully after triumphal receptions at all the stops on the way. As a result of her flight millions of Americans had their attention focussed on the air mail and the wonderful work being done by it daily, and we are indebted to Miss Gatlin for her courage and enthusiasm in seeing it through.

We are getting so used to saying that America is far behind in the development of civil aviation, that we frequently fail to give proper attention to the achievements which have been made. The figures recently published concerning the past twelve months of aerial mail service give a striking record of accomplishment.

The entire aeronautic industry has been conscious of the presence of this service but its real scope and accomplishments are scarcely recognized. The figures given are for the fiscal year ending July 1, 1922.

The planes in mail service covered 1,750,000 miles and carried 49,000,000 letters. This mail totaled 1,224,500 pounds.

92.5 per cent of the trips scheduled were actually completed and 94 per cent of the scheduled mileage was actually flown. This is a record for reliability to which any commercial transportation medium might point with pride.

The air mail service is of interest to the aeronautic industry, chiefly as an experimental route of civil aviation. Its record for the past year indicates the regularity and safety with which a service of this kind can be operated in the United States, given proper organization and careful supervision.

The German Sailplanes

THE achievement of HENTZEN in the glider Vampire in the hills near Wiesbaden—he remained aloft two hours and ten seconds—amazed the professional aviators. And well it might. They knew that the gliding machines of the WRIGHT brothers could not be kept in the air for more than seconds, and that not until a petrol motor was installed in 1903 was there a flight of as much as fifty-nine seconds. Two years were to pass before their plane remained aloft for half an hour and was driven twenty-four and a half miles. At Wasserkuppe, in the Rhön hills, HENTZEN in the Vampire, with no motor to whirl a propeller, contrived to stay up four times as long as one of the WRIGHTS did in 1905, and at the end HENTZEN glided a distance of ten kilometers, a little more than six miles, before landing. What was accomplished with the motorless flying machines in the recent Clermont-Ferrand competitions seems insignificant by comparison. The French aviator BOSSOUTROT succeeded only in "flying" two minutes and fifty-one seconds in a Farman monoplane.

The reason for the German superiority cannot be found alone in favoring winds that blew "from seventeen to twenty miles an hour, with occasional thirty-mile gusts." The French competitors had wind enough, fifteen miles an hour and more. It is evident that the Hanover Institute of Technology, where the German gliders are made, has evolved important combinations of planes or wings and operating levers.

It seems to be fundamental that in calm air such feats as those of the Germans would have been impossible. Wind was required: the more the better, short of a gale. If a light motor were installed in their "gliders," ascents could be made and actual flights effected in a calm, Sailplane, as the Germans call the Vampire, seems to be an appropriate name.

The Aeronautic Situation in Italy

By WILLIAM KNIGHT, M. E.

ONE of the European Countries which has contributed the most to the development of Aeronautics both as science and as a branch of Engineering is Italy.

Italy is one of the few countries that can boast of having made a real and lasting contribution to the development of aeronautical research work and to the realization of some of the best airplanes and seaplanes which have been designed so far.

In dirigible construction, Italy is competing with Germany and the performance of the Italian semi-rigid type during the war has conclusively proved the many advantages offered by this type of dirigible construction as compared to the rigid-type.

Italy has exceptionally good technical men like Col. Crocco, Col. Costangi, Col. Riccaldoni, Prof. Anastasio, Prof. Panetti, Col. Guidoni, etc., and designing engineers like Rosatelli, Conflenti, Tonini, Marchetti, Forlanini, Cappa, etc. Italy has trained during the war five-hundred thousand men in the aircraft manufacturing industry and when the war stopped the Aeronautical manufacturing industry in that Country had progressed to a considerable extent and it was readily admitted that Italy would prove to be a dangerous competitor for the aircraft manufacturing industry of neighboring nations.

In spite of all this, Italy is to-day the only great nation in Europe which has no commercial aviation, no programs for the near future, and a Government, which judging from the results, or rather from the lack of results takes no interest at all in either commercial or military aeronautics.

In a note published by Col. Tuz. G. Costanzi on *post bellum* aviation in Italy, the author who during the war and after the armistice was the representative of the Italian Air Service to the Supreme War Council in Versailles and also technical representative of Italy to the permanent Interallied Aeronautical Commission in Paris, puts squarely the responsibility for such a state of affairs where it belongs.

Immediately after the armistice was signed, while in France, Belgium, England, Germany and Holland every effort was made for keeping alive the aircraft manufacturing industry and for developing gradually the transformation of military into commercial aviation, in Italy a process of liquidation of all aeronautical activities was started by the government and whatever was left of the war-time organization of aeronautical services, kept on changing names and shifting from one department to another.

In spite, however, of the lack of encouragement on the part of the government, and, what is worse, in spite of the handicap placed on the aircraft manufacturing industry by the lack of an aeronautical governmental policy, aircraft manufacturers, or at least the most courageous ones have succeeded in maintaining the high standard of Italian aircraft abroad where they are exported in large numbers and where they are duly appreciated.

It is not comprehensible however, when we look at the map of Europe crossed all over by English, French, Belgian, German, Swiss, Rumanian and even Russian aerial lines that Italy is the only European nation which is not bankrupt and yet does not find it worth while to develop aviation.

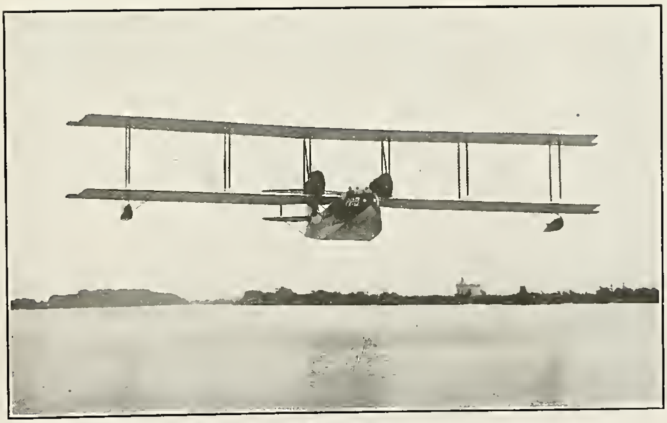
The British press has repeatedly announced the organization in the near future of a large aerial transportation company operating between England, Egypt and the Eastern part of Europe. This company will be formed, it seems, with British capital and for the purpose of furthering British interests in the Orient.

The Italian press has repeatedly pleaded with the Italian Government for the protection of Italian Aeronautical interests in connection with the operation of international lines. If it is true that foreign aerial companies are going to be operated in Italy without any participation of Italian capital and without any reciprocity of advantages being stipulated for between the Italian and foreign governments, the hint conveyed in the Italian press to the Italian Foreign Office to consider aeronautics as an international issue and not as a local matter is probably justified.

At any rate we sincerely hope that something will be done in the near future for starting commercial aeronautical activities in Italy with the co-operation of the Government, aircraft manufacturers and Italian capital.

Aeronautics needs the co-operation of every nation and the good will of the people of the world in order to develop into a means of bringing together the citizens of all nations for the peaceful pursuit of their commercial interests. It would be a bad policy to establish over any nation the aeronautical supremacy of another country. It would not be conducive of good feelings in the long run and it would defeat the main purpose of aeronautics which is the international commerce in the interest of all nations.

We need co-operation in Aeronautics, we do not need individual supremacy in the air by any nation.



The Pogna-Rossi-Bastianelli flying boat equipped with four Isota-Fraschini engines.

THE NEWS of THE MONTH

Hartford Aviation Meet

Fourteen events, calculated to demonstrate the advance in aircraft design, construction and operation during the past year, make up the Armistice Day program for Hartford's second annual Aviation Meet. City officials in charge of the municipal airport are assisting the local Aero Club to make the enterprise surpass anything of the kind heretofore staged in New England. Enthusiastic participation has been promised by the War, Navy and Post Office Departments, and liberal inducements, including free hospitality and supplies, have been offered aircraft manufacturers and operators to take part.

All participants are to arrive in Hartford and register during the afternoon of Friday, November 10. The formal program will be carried out next day, when the industrial establishments generally will close down on account of Armistice Day. Sunday will be available for passenger carrying by all who may choose to engage therein. Lieutenant Samuel T. Mills of the U. S. Air Service will be in direct charge throughout the same as last year.

"Stunt flying" will be prohibited throughout the entire meet, but liberal prizes are offered in connection with the following features: (1) Largest number of planes sent by individual, aero club or manufacturer; (2) Largest delegation sent by a Goverment Station; (3) Most popular plane as designated by vote of spectators; (4) Greatest mileage flown direct to Hartford; (5) Free-for-all race 45 miles triangular course; (6) Class A race for planes rated up to 125 miles per hour; (7) Class B race for planes rated up to 100 miles; (8) Altitude contest unlimited; (9) Fifteen minute altitude contest; (10) Accuracy landing from 1500 feet; (11) Free-for-all seaplane race to Springfield and return; (12) Relay race—each team to comprise two Class A and two Class B ships; (13) Bomb dropping from 500 feet; (14) Bursting toy baloons.

Announcements of the meet sent out by H. Terry Morrison, Chairman of the Flying Committee, are particularly designed to interest and aid visiting pilots. They show a general map of Hartford and vicinity showing all features of the municipal airport, and an airscape of same from 1500 feet elevation with the city as the background. Funds appropriated by the city to relieve un-employment last spring, were expended in smoothing the surface of the 100 acre landing field, until "best in the country" has become the general verdict of visiting aviators.

248 Miles an Hour

Travelling at a greater speed than any human being ever before attained, Lieut. R. L. Maughan, a United States Army pilot, on October 16 at Mt. Clemens, Mich., set a new world's airplane speed record by covering a one-kilometre course at the rate of 248.5 miles an hour.

The record was made during official Government tests of speed planes that participated in the national air races at Selfridge Field and was electrically timed by officers from McCook Field.

Aeronautical engineers and army and navy officers who witnessed the flight were astounded. The demonstration, they declared, proved that there is no limit to the speed that might be attained in the air.

Lieut- Maughan made the record-breaking flight in the same plane with which he won the Pulitzer trophy race on Saturday. The machine is a Curtiss army biplane, powered with a Curtiss 400-horse power engine.

After setting the new record, Lieut. Maughan continued his flight to show that the tremendous pace could be maintained. On four laps he was timed at the rate of 232.22 miles an hour, and his average for eight laps was 229 miles an hour.

Examination of the machine after the flight disclosed that it was in perfect condition and that nothing in the nature of a trick flight figured in the record performance.

Later Lieut. Maughan added to the astonishment of pilots and officials on the field by flying approximately one mile with the machine on its side. The feat in reality was a flight without the aid of wings. In other trials during the day the speed record for monoplanes was shattered by one navy and three army machines.

Lieut. Barksdale covered the one kilometre course at the rate of 191 miles an hour, and Lieut. Whitehead made 187. They drove Loening-Packard planes. Capt. Hunter, in a Thomas Morse, was timed at 179 miles an hour and Lieut. Calloway, in the navy's bee line racer, made 177.

The trials will determine, to a large extent, the type of machines to be developed for the army and navy. Maughan's flight was said to have made it virtually certain the army would select the Curtiss-Army biplane as the standard pursuit type.

Navy Tries Out Balloons to Be Towed by Warship

Successful test of a new dirigible balloon, designed, it was said, to replace the captive observation balloons of the World War, was conducted at Wilbur Wright Field, October 14, by Charles Branningan, test pilot, of Akron, and Ensign Charles Bauch, United States Navy.

Under the test the balloon arose 500 feet in the air and was attached to a motor truck. It was pulled to various points on the field, then cut loose, and under its own power cruised about, coming back to the truck, where a drag rope was picked up and the ship towed back to its mooring.

It was pointed out that the balloon might be towed astern a battleship and, after cruising about for observation, might again be attached to the ship. The new ship, slightly larger than a pony blimp, is ninety-five feet in length and is driven by a single motor. It eventually will be assigned to some navy aviation field, it was said.

French Flyers Fail to Equal U. S. Mark

The French aviators, Lieutenant Boussoutrot and M. Drouhin, who ascended in a Goliath biplane in an attempt to beat the American duration flight recently made at San Diego, Calif., by Lieutenant John A. Macready and Oakley Kelly, landed after having remained in the air 34 hours, 14 minutes and 32 seconds. They thus failed to equal the record of Macready and Kelly, which was 35 hours, 16 minutes and 30 seconds.

The French Aerial Federation, however, considers the mark set by

Bossoutrot and Drouhin an official world's record, contending that the American flight was conducted under such conditions as will not be accepted by the international federation, of which the United States is a member.

"I have been to America and half way back again," Bossoutrot said on alighting from the plane, wrapped up in heavy furs. The aviators were forced to land through lack of gasoline, of which they had taken 4,200 litres when they started.

The Goliath traveled 3,200 miles, according to the instruments, which were sealed before the departure. It always kept within sight of the walls of Paris and was in constant communication by wireless with the Le Bourget.

National Aeronautic Association

The recognition of the need of a truly representative national body to advance American aeronautics led to the formation of a Joint Committee in 1921 representing the Aero Club of America and the National Air Association, with Howard E. Coffin, of Detroit, as Chairman. This Committee decided upon an Aero Congress at which should be formed the National Aeronautic Association.

Temporary offices were established in Washington and in Detroit and the date of the Congress set coincident with the National Airplane Races in Detroit, October 12 to 14th, 1922. An Advance Committee on Organization, composed of five hundred leading aeronautic enthusiasts, was formed and of this body an Executive Committee of thirty was appointed. Upon the suggestions and advice of these committees the Second National Aero Congress was held.

More than four hundred delegates representative of many states, cities civic organizations and aero clubs and various aeronautic interests, responded to the call of these committees. By-laws were adopted, officers and governors elected, and National Headquarters established in Washington. The new Association was incorporated October 14th, 1922, as a non-profit membership corporation, the papers being dispatched from Detroit to Hartford, Connecticut, by airplane, and incorporation completed on the day of adjournment of the Congress.

Officers elected were as follows: Howard E. Coffin, President; Bernard H. Mulvihill, Vice-President; Benjamin F. Castle, Treasurer; John B. Coleman, Recording Secretary.

Governors elected, two from each district, were as follows: 1st District: Porter Adams, Godfrey Cabot; 2nd District: John Larkin, Jr., Maurice Cleary; 3rd District: L. F. Sevier, R. J. Walters; 4th District: Van H. Burgin, L. Sevier; 5th District: Glenn L. Martin, Dudley M. Outcalt; 6th Disttrict: C. S. Dieman, Sidney D. Waldon; 7th District: Ralph Cram, H. F. Wehrle; 8th District: Edgar G. Tobin, William F. Long ; 9th District: P. G. Johnston, C. H. Messer.

In addition, by the provisions of the by-laws adopted, five Governors-at-large are also to be elected by the Governors mentioned above. Such election will take place shortly as will also the appointment of an Executive Committee of the Board of Governors, authorized by the By-laws.

Personnel of the National Headquarters has been partially selected and installed in Washington and consists at present of men in charge of Administration, Contests and Foreign Relations, Membership, Finance Legislation and Publicity. Full membership on these various committees is now being selected by the President by and with the advice of the Governors.

Mr. H. E. Hartney has been appointed Acting General Manager.

The purposes of the new Association are briefly as follows:

(a) To maintain in the headquarters of the Association in Washington an agency capable of voicing a vigorous public opinion upon beneficial and essential legislation in all matters of aeronautics;

(b) To awaken and educate the public mind to the possibilities of aeronautics, both as a vital means of national defense and as a transportation factor in the commercial development of our country;

(c) To supply an impartial medium thru which the thought of all sections of the country may be collected, collated and harmonized into a national expression of opinion;

(d) To encourage and promote the study and advancement of the science of aeronautics, and to maintain an institution which will collect and disseminate general and technical data for the development of the industry;

(e) To sanction and actively supervise under license of the Federation Aeronautique Internationale all contests, trials, competitions and other events involving aerial craft or apparatus, and to approve all records in connection therewith.

The Governors of the Aero Club of America and the Governors of the National Air Association, the two largest aeronautical bodies in America, have already voted to merge their membership into the new association and steps are now being taken to have other smaller aero clubs and flying organizations to take similar action.

Arlington Radio Station

The installation of a recording wind vane, anemometer, and sunshine recorder on the 600-foot radio tower at Arlington, Va., has been completed, and information concerning current wind conditions is now available to aviators. Data may be obtained by calling phone Washington "West 81" and asking for "Aerological data."

2. The following information of value to aviators is hereby made available:

(*a*) Current wind direction and velocity can be obtained instantly at all times and in any weather at an altitude of approximately 785 feet above sea level (600 feet above the surface at Washington).

(*b*) An indication of the thickness and probable duration of fog and low-lying clouds at Washington is given by the record of sunshine at the top of the tower.

The De Haviland 4a with Rolls Royce engine which won the King's Cup Race in Great Britain. Piloted by Capt. F. L. Barnard

THE AIRCRAFT TRADE REVIEW

Aerial Mail Performance

Ten weeks of 100 percent performance on all three divisions of the trans-continental air mail service will have to stand as the record for awhile. A radio from Iowa City reporting a default on account of bad weather ended the longest period of perfect flying the air mail has made.

From the second week in July through the third week in September every air mail plane left its field according to schedule and the mail was carried the entire way to the destination by air. Each plane carries from 400 to 500 pounds of mail containing approximately 20,000 letters on each trip.

For the last year 92 percent performance was made by the air mail. Fortified by the excellent record of this summer, it is hoped that this year's performance report will be even better.

The Goodyear Semi-Rigid Dirigible

In building its first semi-rigid airship, America will have the aid of Umberto Nobile, distinguished Italian engineer and co-inventor of the demi-rigid type of lighter-than-air ships.

Engineer Nobile, to give him his official title, is managing director of the Italian government aircraft factory near Rome, and comes to America about October 1st on a three month's leave of absence, to assist in the calculation for building the 300 foot semi-rigid airship for the U S Army now under way at the Goodyear Aeronautic factory.

The semi-rigid type of ship originated in Italy just as the rigid or Zeppelin type originated in Germany and Engineer Nobile is the foremost authority on this type of ship in Italy, and consequently in the world.

In engaging him to come to America, The Goodyear Tire & Rubber Company which has the contract for building the huge craft, wanted to take every possible precaution of safety and Engineer Nobile will personally calculate all the stresses that a semi-rigid is subject to during flight or when moored out in the open.

Engineer Nobile has just completed the designs for a new semi-rigid ship for the Italian government, only slightly smaller than the one being built for the American Army, and expects to get back in his own factory by the time construction is under way, so he can supervise that work.

The projected American ship, also called a "mother" airship, since it can be used as an airplane carrier, will be as long as a city block and its great gas bag will have a capacity of 750,000 cubic feet. An idea of its size can be had from the fact that the largest non-rigid ships built in this country have a capacity of 180,000 cubic feet of gas, though some 203,000 cubic feet helium ships will be built next year.

It will have a speed of 70 miles per hour and a cruising radius of more than 4000 miles and will be able to pick up and release airplanes while flying at full speed.

The distinguishing feature of the semi-rigid ship is its metal keel running the length of the 300 foot gas bag. The power cars containing engines and propellers and the navigator's car are to be suspended from this metal keel, while the huge gas bag will be attached to it at intervals of 10 feet.

It will be the largest semi-rigid ship in the world when it is completed the only larger American airship being the rigid ship ZR-1 now being built by the U S Navy at Lakehurst N. J. and at Akron. The rigid ship will be 630 feet long and have a series of gas compartments or ballonets, with a total gas capacity of about two and a quarter million feet.

Both airships are to be completed next fall, and will enable the American government to test out the relative usefulness of the two types.

Aerial Photography Progressive

"The aerial camera is taking an economical and highly important part in the reconstruction of the devastated areas of France and in the restoration of the arid regions of Egypt and Mesopotamia, which in ancient times were the centers of civilization," said Sherman M. Fairchild, a Governor of the Aeronautical Chamber of Commerce, and President of the Fairchild Aerial Camera Corp. on his return from Europe.

"It is stimulating to learn that America leads the major European nations in the scientific development of aerial photography, but in the practical application of the art on a national scale we must look to France as the leader. The French, since the ending of the war with Germany, have systematically set about the development of aeronautics through utilization of every service offered.

"Shortly after the Versailles treaty was signed, a French law was passed requiring every city in the republic, above a certain size, to be resurveyed within three years. It would have been physically impossible and financially impracticable to accomplish this by ground methods. The result was that mapping by air was adopted throughout and one company alone surveyed 200 cities from airplanes.

"Aerial mapping is being extensively used by the Ministry of Liberated Povinces. The areas of France devasted during the war are being resurveyed from the air, as in many cases not only were property lines obliterated, but the records of entire communities destroyed.

"The City of Paris was mapped from the air to a scale of 200 feet to the inch, thus making it possible to identify even small buildings. Corrections, such as new structures, streets, etc., were printed in red over the existing maps. For this air mapping work the French company received the equivalent of $400,000."

Mr. Fairchild believes that a rich field for development in aerial photography awaits American companies entering Central and South America, and such European countries as Spain, Greece, etc.

L. W. F. Giant Bomber Successful in Trial Flights

The giant bombing airplane "Owl" designed and built by the L-W-F Engineering Co. Inc., College Point, N. Y. and known as their Model H-1 was successfully test flown on Saturday 16th inst. The machine is a redesign of the original "Owl" which was wrecked at Langley Field, Va. in 1921 and much of the original structure was salvaged. It will be remembered that the first "Owl" was a mail carrier but taken over by the Army service. It proved safe and airworthy but entirely unsuited to military requirements. While proceeding with the repair work the L-W-F. Engineers submitted designs to the Engineering Division showing a complete revision of type and suiting the machine to all requirements for a bomber of the latest class which were favorably received and authority given to proceed with the new design.

The "Owl" as redesigned has a crew arrangement somewhat similar to that proposed under the Army specification for Type XIII. Two pilots are seated in a central nacelle slightly forward of the front spar. The controls are dual or equally accessible to either man and double control wires are used throughout. A bomber's cockpit is located below and slightly ahead of the pilots. Sign communication so important in this type is very convenient. The bomber has vision slightly above the horizontal in approach and about a 15 degree trail angle and can see the nose of his bomb at all times. A rear gunners cockpit is provided in the after part of the same nacelle. A double Lewis gun on a scarff mount commands the entire upper hemisphere with a good part of the lower. In addition a remote control Lewis floor gun is provided for the defense of the lower hemisphere. Provision is made for the mounting of a forward gun but this has been omitted as inconvenient for use while the dual control is in use. A crew of four is therefore required but provision is made to accomodate four additional men in the center of this nacelle if so desired.

All fuel is carried in the two fuselages miminizing danger to the crew in case of a crash. Sufficient for over five hours at high speed is carried. A "Pyrene" sprinkler system working under pressure is installed in each motor compartment. The motor controls are very interesting and were designed by the L-W-F company known as the "Arens" control. These will be described in a later issue. A carrier for a 4000 lb. bomb is mounted directly under the lower wing. Two 2000 lb. bombs may be carried with equal convenience by mounting two additional carriers. L-W-F type monocoque construction is used for fuselages and nacelle. The weight fully loaded is given as 18,000 lbs. and 22,000 lbs. with the bomb load. The span is 106 feet and a U. S. A. type No. 6 wing curve is used. Three Liberty 12 engines are used. A speed of 106 m.p.h. has been obtained in the trials.

The trials took place at Mitchell Field. Lt. Melville was the pilot and took with him on the initial test Donald R. Black designer F. W. LaVista and Chas. Arens of the L-W-F Company. The machine was taken off after a very short run and flown for half an hour. A perfect "three point" landing was made ending the run within a few feet of the point desired. A second flight was made immediately after and a full crew of passengers taken up. Lt. Melville pronounced the machine as entirely satisfactory and a decided improvement over the original. General Patrick made an inspection tour of Mitchell Field and was taken for a trip in the "Owl". He expressed great satisfaction at the apparent ease of control.

Airplane Landing Field Layout

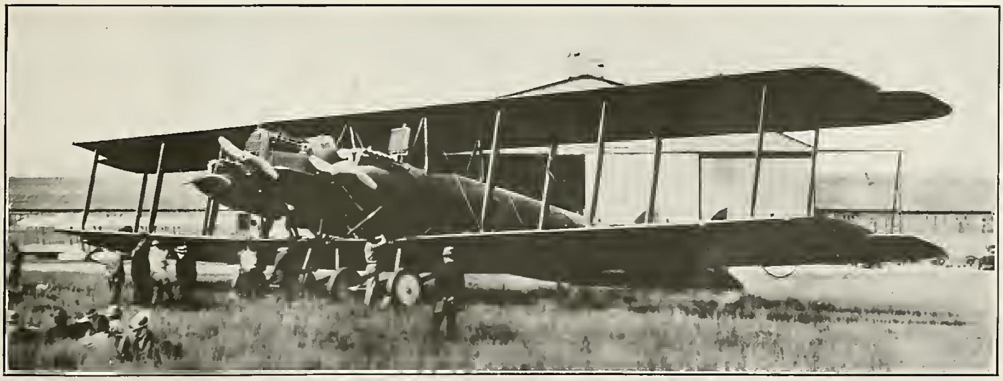
The September 28th issue of the Engineering News-Record contained an illustrated article on the arrangement and construction of airplane landing fields, written by Archibald Black. This paper—probably the first really constructive discussion of the subject published—takes up the problem from the viewpoint of the municipal engineer.

In an editorial commenting upon the article, which appeared in the same issue, the significant suggestion is made that landing field activities may extend the field of work of the municipal engineer.

Mr. Black's paper takes up and discusses in detail each of the important points to be considered. Illustrations of possible field arrangements and of an ideal field layout are given. A novel method of layout is proposed to provide for the future expansion as the size of airplanes increases. This consists of arranging the building area into plots of 200 by 200 feet, thus permitting the erection of ultimate hangars of 200 by 200 feet should the size of future airplanes warrant this. A composite building plan is included to show that the proposed large plot can be used to full advantage for the smaller sizes of buildings in the meantime.

The size and type of runways are discussed together with recommendations for their construction. The important questions of drainage and field surfacing are considered. As there appears to be a quite general impression that grass is merely "grass", it may be news to many to learn that no less than *eight* different types of grass seed should be blended to ensure the raising of proper turf.

International location markers and field markers are described and suggestions made for their construction. In closing, the author devotes some space to a general discussion of water, power, transportation and similar facilities.



The L-W-F Owl Which Was Recently Flight Tested Successfully

ARMY and NAVY AERONAUTICS

Airplane Forest Patrol Commended

The excellent work performed by the detachment of the 91st Squadron (Observation), stationed at Eugene, Oregon, in connection with the aerial patrol of the Oregon forests, has occasioned much favorable comment from all sides. The following letters addressed to Captain Lowell H. Smith, in command of the detachment, tend to show the attitude of others than those immediately connected with the Air Service towards the patrol of the forests by airplanes.

A letter from the Douglas County Fire Patrol Association is as follows:

"This association has found the new system of patrolling as maintained this season to be extremely satisfactory. We believe that from our standpoint the maximum amount of good can be accomplished by the Air Service patrol as maintained this season. It affords us a much better chance of combating fires after they are located, in determining what steps to take. Taking it as a whole the service has been very satisfactory.

The patrol as maintained has also been very beneficial in making the ground force more efficient, as the men on the fires know that we have a personal supervision of their work and can tell whether or not they are using the greatest amount of effort. It also has a good moral effect on campers, tourists and stock men. We find the ranchers more reluctant in setting slashing fires without permits and the hunters and fishermen have their attention called to the fire hazard by seeing the airplanes flying over the territory in which they are located."

The following communication is from the Booth Kelly Lumber Co.:

"There has been some discussion regarding the value of the air patrol in forest fire protective work. During the present dry season, because of smoke blowing in from the north, which is the general rule and not the exception, look-out stations have been practically of no value and the vision of the patrolmen has been very limited. Observers in your ships have been able to detect fires which would not have been discovered in any other way until they had gained considerable headway. In scouting over large fires they are able to give information to fire-fighting crews which cannot be gained as quickly or as accurately in any other manner.

It would seem that the results accomplished this year would convince the most skeptical and that should the Department at Washington know the true value of this work there would be no uncertainty regarding the future yearly patrol.

We wish to extend to you and through you to the others in your organization our high appreciation of the courteous and efficient service given our association the present season."

Captive Helicopters May Displace Observation Balloons

"Well, here it is, what good is it?" said an aeronautical engineer as he watched the successful flight of the Berliner helicopter.

"What good is a new born child?" was the retort of an army officer not unfavorably known for good ideas and initiative. "It's got to grow and make a place for itself."

The helicopter idea is as old as the airplane. Some had the idea that it could be put to practical use not only in war but in peace time. The German empire must have had some ideas when it started official work on a captive helicopter in 1916. There is still open the British prize of £50,000 for a practical device.

What might not be possible in war, say, with a little frame, an armored box for the observer, and electric motor and propellers, driven up to any desired height through electric current from the ground and held captive. Might it replace the bulky and comparatively unwieldy kite balloon. The helicopter claims the advantage of low perceptibility and therefore a small target for artillery, armament against enemy aircraft, especially good field of fire overhead, incombustibility, rapid movement of its position.

An Austrian balloon company on the front with 1 balloon required 1 automobile winch car, 2 gas cars, 3 auto trucks, 6 officers and 137 men. The hell-bent-for-helicopterists claim that the common or garden variety of helicopter needs but 2 trucks, 3 trailers, 6 officers and but 20 men.

The Navy would find use for it on board ship, where the necessity for altitude is not so great as with land forces. For home defense, for searchlight mounts and for detection of enemy aircraft at far distances. An unmanned helicopter carrying recording instruments could be used in any kind of weather by the Weather Bureau or meteorological section of an air service. It might, unmanned, be used for radio where heavy masts are out of the question.

The thought of a captive power-driven aircraft is novel, to say the least. The use of a gasoline engine to take it from place to place might do away with the automobile trucks for transportation of an electric machine.

However, speculation as to achievement of actual sustentation of the airplane. Some had the idea that it past. The Berliner helicopter actually sustained itself.

New Navy Training Plane

A new type of training plane for the training of student naval aviators which combines safety features, never before equalled in aircraft, with qualities of speed and maneuverability has just been delivered at the Naval Air Station, Anacostia, after a flight of seven hundred and sixty miles from Ogdensburg, N. Y. The plane was flown from Ogdens-

The Army blimp which made a cross-country flight from Ross Field, Va. to Arcadia Field, Cal.

burg to Washington in ten hours flying time by Commander T. G. Ellyson, of the Bureau of Aeronautics, accompanied by G. B. Post a representative of the builders.

The plane will be known as the Huff-Navy, HN-1, and was built to Navy specifications by the Huff-Daland Company of Ogdensburg. Tests conducted at the factory and subsequent flights notably the one from New York have demonstrated excellent qualities of stability in the plane which renders it of exceptional value for training purposes.

A recent demonstration conducted by a Navy pilot under the supervision of naval inspectors showed that the HN plane was all but capable of flying without a pilot. A description of the test by Commander Ellyson is sufficient to give an accurate idea of the stability demonstrated by the plane. "In testing the plane for stability the pilot released the controls, taking his hands and feet off them. The throttle was cut to low speed and the plane went into a long glide. He then speeded up the engine and still without the controls being touched the plane leveled off and continued in normal flight with the engine turning up from 1100 to 1200 revolutions and the plane making about 60 knots. Finally the engine was speeded up with the throttle wide open. The plane began to climb and in doing so her speed was cut to about 40 knots. She fell off on one wing and dove until a speed of 100 knots was registered when the plane again leveled off in normal flight. During the entire demonstration, the Pilot, Lieut. Nielson, did not touch the control with either his feet or his hands."

The HN is equipped with a Wright engine built by the Wright Aeronautical Corporation. This is the engine which recently passed a record breaking test of 250 hours duration on a Navy test stand in Washington.

Lighthouse For Navy Pilots

A special light for air stations has been put into operation at the Naval Air Station at Hampton Roads, Va. This is a 6000 candle power white light, flashing every three and one third seconds. It has an elevation of 65 feet above mean high water and is visible 20 miles horizontally. The rays from this light diminish in intensity towards the zenith. This feature of construction is necessary in order that an approaching aviator will not be blinded by the upper rays when close to the light.

This aerial beacon is operated by acetylene and functions automatically. It is controlled by a "sun valve," which works on the thermostatic principle. During daylight hours the valve is expanded by absorbed light rays and the main light is extinguished. After dark the valve contracts and allows the light to start functioning. A small pilot light is kept burning continuously for the purpose of lighting the main flame.

The object of this light is as a guide to aerial observation and to aid in locating the Naval Air Station.

Rapid San Antonio-New Orleans Flight

Captain W. P. Hayes and Master Sergeant C. W. Kolinsky of the 90th Squadron, stationed at Kelly Field, San Antonio, Texas, recently made a test flight to New Orleans, La., with a remodeled DH 4 airplane. They left Kelly Field at 6.15 a.m. and made the 560 miles to New Orleans in four hours and thirty minutes flying time, or at the rate of slightly over 124 miles an hour. One had only to do this trip by train at a temperature of 94 in the shade to become an enthusiastic exponent of aviation.

Captain Hayes reports that, although the field at New Orleans was supposed to be in good condition, well soded, he found the grass about eight feet high. However, after negotiating a landing, it required four mules and eight men to get the ship out. The mules were furnished by the Park Department in preference to cutting the grass. Captain Hayes reports that every courtesy was shown by the city authorities and various civic organizations. They stated, in explaining the condition of the field, that Captain Hayes' ship was the first one to stop at New Orleans for some months. It would therefore seem advisable to encourage the municipal landing fields by more frequent flights.

Investigating Landing Fields.

Lieutenant C. H. Howard, Air Service, recently returned from a fifteen hundred mile cross-country trip into Maine and Vermont, where he marked emergency landing fields and selected five large tracts of land which will be suitable for use in concentrating large divisions of the Air Force in case of emergency.

Lieutenant Samuel M. Connell, Air Service, performed a similar mission through Northern New York, Connecticut and New Hampshire, traveling 1200 miles. He marked all emergency fields and located six large tracts of land near certain of the larger towns of New York State where encampments could most easily be located in time of emergency.

Flight Surgeons' School Opens

The Medical Research Laboratory and School for Flight Surgeons at Mitchell Field, L. I., New York, opened its fall term recently with a class of twenty students in attendance, twelve of whom are Naval officers and eight Medical officers of the Army. They will remain at Mitchell Field for a three month's course, upon completion of which they will be returned to their original stations for duty as Flight Surgeons, either in the Army, Navy, or Marine Corps.

Navy TS and TR Planes

The TS-1 airplane represents the original development of the TS type and this design was prepared under Commander Hunsaker's direction to fulfill the need for a reasonably high speed combination land and seaplane single-seater fighter biplane ostensibly for use with the fleet. The type has been designed for catapulting as a seaplane from battleships and can also be launched as a land plane from an aircraft carrier.

The development of the TS type represents a distinct advance in airplane design and embodies several noteworthy features.

Wood and fabric construction is used throughout, except for struts, which are of steel. Few wires are used for external bracing, steel tubes being substituted to facilitate rapid assembly and take down, and to reduce head resistance. The upper wing is one unit and is but 25 feet in length. The lower wing comprises a center section and one outboard panel on each side. All wing and strut attachments are effected by single bolts and adjustment is provided for struts where necessary.

The overall height of this airplane has been made a minimum by placing the fuselage above the lower wing and allowing minimum clearance of the propeller above the water. Twin floats are employed, only four supporting struts being used for each pontoon and only two longitudinal bracing wires.

A noteworthy feature in the fuel system is the location of the gasoline tank, which is placed in the center section of the lower wing, provision being made to release this tank in flight in case of emergency.

The TS type is probably 25% smaller, hence more compact, than any other comparable plane known, and this achievement has been reached by the application of the results of recent scientific development on wing, tail, and control surfaces, combined with an original general arrangement and special attention to the general and detail structural features.

It has been a gratifying result in the development of this design that the actual weight of the finished product fell within a few pounds of the calculated weight, and the high speed actually developed resulted about 2% higher than that predicted.

The modifications of the TS, such as the TS-2, TR-1, and TR-3, are experimental types constructed for comparative purposes, using different engines and wings.

The TS-1 was designed around the Lawrance radial air-cooled engine rated at 200 horse-power. The TS-2 employs an Aeromarine eight-cylinder, water-cooled engine. The TS-1 and TS-2 afford a direct comparison between the two types of engines; no actual flights, however, have been made with the TS-2.

The TR-1 and TR-3 types are practically the same as the TS-1, except that the wing section employed is different, it being intended to develop a faster modification of the TS-1 for experimental purposes. Here again a comparison between air and water-cooled engines is contemplated, as the TR-1 employs the Lawrance engine and the TR-3 the Wright Model E-3 water-cooled engine. All these engines develop the same horse-power on the block.

While these seaplanes were not designed for racing purposes, the advantages afforded of entering them in the Detroit Races have been taken, as the experimental results derived from racing in general are extremely valuable and, of course, a racing prospect always stimulates production.

Characteristics and Performances

	TS—1	TS—2	TR—1	TR—3
Span	25′ 0″	do	do	do
Length	24′ 7″	do	do	do
Engine	Lawrance J—1	Aeromarine U—8—D	Lawrance J—1	Wright E—3
Horsepower	240	240	240	240
Weight, empty	1345	1407	1345	1570
Useful load	500	500	500	500
Total weight	1845	1907	1845	2070
High speed (mph)	124*	127	136	140
Climb in 10 minutes	13000	12000	13000	11000
Ceiling (feet)	23000	22000	23000	20000

*Actual performance

The above table is for these planes loaded for entry in the Detroit Races. As service types, the useful load would be increased 180 pounds and the horse-power reduced to 220. The effect of this would be to reduce the high speed about 3%, the climb in 10 minutes would be reduced about 18%, and the ceiling about 8%.

Catapults and Short Landing Devices

For many years the catapult device for launching airplanes at full flight speed from ships' decks has been a matter of experiment and practice in the U. S. Navy until it has now become a definite equipment. There remains its application to commercial or civil aeronautics, next, to permit the departure of airplanes from small spaces on the ground, or from buildings close to business districts of cities. A great drawback to aerial passenger transportation is the present necessity of an aerodrome on the outskirts—with high valuations, loss of time in reaching it, the temporary character imposed by the expansion of real estate programmes.

Coincident with this development must be that of a system for landing in about the same space. Many large buildings offer proper spaces where a suitable landing device is existent.

Many years ago Eugene Ely made one successful experiment in landing upon a platform erected above a ship's deck. The Bureau of Aeronautics of the Navy has now taken up this phase and has conducted some practical experiments which may point the way to a fully satisfactory apparatus or method.

In short, the system thus far tried consists of a series of wires placed across a platform, at a proper height, to the ends of which wires are attached weights in the form of bags of sand. The 'plane is brought into line with the platform and makes contact at one end in the normal manner. A hook on the landing gear engages one of these wires and picks up the burden of the dragging weights. A second wire is engaged, which adds its load to the first and so on to a point where the 'plane is at a standstill.

In one of the trials an airplane was brought to a stop within 38 feet. The distance depends upon the landing speed of the particular airplane. The higher the flight speed, the higher the landing speed is the usual formula.

Flying Along the New Airway.

The first official regular trip on the new airway connecting McCook Field, Dayton, Ohio, with Mitchel Field, Long Island, New York, and Langley Field, Va., via Bolling Field, Anacostia, D. C., and Moundsville, West Va., was recently made by Lieutenant Samuel P. Mills, pilot, and Lieut. Van Meter, passenger. One hundred pounds of photographic supplies, destined for Washington, were carried. Excellent weather was encountered, the round trip from McCook to Langley and return being made in about 10½ hours' flying time. One unscheduled landing was made close to Cumberland on the return trip but no damage resulted.

Lieut. Mills declared himself very enthusiastic over the airways development.

The Officers of the Communication School are Capt. L. P. Hickey, Commanding, 1st Lieutenants J. H. Gardner, Stanley Smith and J. T. Harris. The Communication School Detachment consists of 21 enlisted men.

Both of the above schools are shortly expected to be in operation.

Brook's Field Gets New Hospital Plane

The Primary Flying School at Brooks Field, San Antonio, Texas, recently received a new white hospital plane, designed and built by McCook Field, and delivered via the Repair Depot at Kelly Field No. 1. This plane is a remodeled Curtiss JN6, equipped with a Wright motor, 180 h.p. The fuselage is enlarged to acommodate the patient in a prone position. A seat facing the patient between patient and pilot, has been installed for an attendant. The plane with full load has been given several tests flights by pilots from the field and it is reported that, although it is an ideal ambulance plane so far as the patient's comfort is concerned, it is loggy, nose heavy and slightly underpowered. It is also slower in getting off than a Standard Curtiss JN 6 with 150 h.p. Wright motor.

REVIEW of WORLD AERONAUTICS

Gibraltar Aviation Base

That great Britain plans to make Gibraltar the most formidable air base in the whole world is alleged by the Spanish aviation magazine Avear.

"The British," says the journal, "have of recent years laid much stress on the fact that owing to changed conditions of modern warfare, both on land and sea, Gibraltar to a great extent has lost its former strategic importance. But the historic rock now enters a new phase. British engineers are busy planning the transformation of Gibraltar into a huge subterranean air station. The hillside will be tunneled in all directions, with vast cellars in which great fleets of airplanes and seaplanes will be in absolute safety from enemy attack. Huge oil tanks, repair shops, bomb and aerial torpedo stores will be complete in the mighty arsenal.

"In the centre of the rock a large hall will house the planes, with galleries running in all directions of the compass to outside landing stations. There will be several tiers connected with each other by powerful elevators. This plan will enable the British to concentrate the largest air fleet ever seen in the world in a place of absolute safety, ready at any moment to sally forth to support naval squadron or undertake offensives over a very wide radius of action.

"Gibraltar will thus regain its former importance as a strategic base, and again become the crouching lion against whom nobody will dare attempt to dispute British sovereignty over the columns of Hercules."

New French Plane

An all-metal battle plane, mounting one French seventy-five field gun, was delivered to the French Government at the Villa Coublay Aerodrome, October 15, by Schnider Steel Company, which owns the Creusot Works.

The plane is driven by four motors of 400 horsepower each. It weighs more than ten tons. Its speed is more than 100 miles an hour. It is a night bombardment plane, capable of carrying several tons of bombs in addition to two pilots, a mechanician and a gun crew. A field gun has been specially mounted on it. The plane can carry fifty shells if necessary. It already has passed the builder's trials, but has not yet begun the Government's trials.

Italian Speed Record

By attaining a speed of 209 miles an hour, Brack Papa captured the world's airplane speed record for Italy and ousted the French champion Sadi-Lecointe from a position he has held for the last two years.

The Italian made his attempt on the world's flying records over the Mirafiori aerodrome, in the suburbs of Turin, with a Fiat R. 700 biplane. In order to be officially accepted, these record flights have to be made both with and against the wind, the average time of the runs being taken as the official figure. Four trips were made over the kilometre, the fastest of these being in $10\,{}^{3}/_{10}$ seconds, or equivalent to 217 miles an hour. It is interesting to note that the first world's speed record in the air was established in 1906 at 26 miles an hour.

Brack Papa's machine is a special Fiat construction equipped with a 12 cylinder V-type water cooled engine of 700 h p. It is with this machine that he will take part in the race for the Deutsch Cup, where he will have to meet British and French competition. Brack Papa also holds the world's speed record for 100 kilometres (62 miles) in 20 min., 5 2/5 sec.

The Fokker F-3, equipped witb Rolls-Royce Eagle, now in service between Amsterdam and London. It is one of the most efficient European designs.

Seaplane Round the World Flight.

The Air League of the British Empire is sponsoring around the world flight by seaplane.

The machine which it is proposed to use is a Fairey seaplane of the twin-float type, and the machine will be driven by a 600 h. p. Rolls-Royce "Condor" engine. The three aviators who are to make the attempt are Capt. Macintosh, who has for so long been associated with the Handley Page London-Paris air services; Capt. Tymms, of the Air Ministry Navigation Department; and Capt. McCloughry, of the Australian Flying Corps. Capt. Macintosh has had unique experience of flying under all sorts of weather conditions, and he has on several occasions succeeded in bringing Handley Page machines across the Channel in weather which kept the Channel steamers in port. We do not know how much experience Capt. Macintosh has had of seaplane flying, but as the machine to be used is a twin-float seaplane, its handling should not be so very different from that of a land machine.

Regarding the machine itself, but little information is available at the moment; but it will probably follow fairly closely upon the lines of the long-distance machine on which the Portuguese aviators Cabral and Coutinho started out on their trans-Atlantic flight from Lisbon. Thus the type has been thoroughly tried out, and the lessons learned with the first machine should enable the constructors to incorporate any improvements which experience with the first machine may have suggested. We understand that the twin-float seaplane has been chosen mainly because in case of damage it is easier to repair or replace a float than it is to repair the hull of a flying boat. We do not know if it is the intention of the aviators to fit a land undercarriage for some of the stages of the flight, but it would appear that to do so would be a fairly simple procedure, and, in a measure, the effect would be similar to that of using an amphibian machine, but with the difference that the amphibian gear would not have to be carried on board. Needless to say, the machine will be very fully equipped with all modern instruments, and a wireless set of good range will be carried.

The Roll-Royce "Condor" is, at the moment, not so thoroughly tested out as is the famous "Eagle," which has the trans-Atlantic flights, the Cairo-Cape flight, and the London-Australia flight to its credit. As it is, except for size, designed very much on the lines of the "Eagle," there is no reason to think that it will not worthily uphold Rolls-Royce traditions, especially as, we understand, for most of the stages it will not be necessary to run it at anything like its full power. The most difficult parts of the journey will be from Kamchatka to Canada, and from America to Europe; and for the first part of these stages it is possible that the engine may have to be run nearly all out, until some of the fuel has been consumed. As, however, the "Condor" is very sturdily built it should be able to do this safely for the required length of time. At present the engine is, it will be remembered, being tried out in the Avro 'Aldershot," which made its first public appearance at the Pageant at Hendon.

The route to be followed has not yet definitely been decided upon, but it will be from west to east. The Air Ministry has promised all possible assistance in the way of meteorological and wireless assistance, and it is, we believe, intended to send a spare engine out to Japan. Otherwise it is hoped to be able to complete the whole flight on the same machine. No doubt a few spares will be judiciously distributed along the route.

The actual date of starting has not yet been decided upon, but it appears probable that a start will be made early next year, possibly in January or February, and it is hoped to complete the tour of the world in about three months. We hope to be able to supplement these brief notes with further details later on.

International Air Congress in London.

Following on the Congress International de la Navigation Aerienne held in Paris in November 1921, it is proposed to hold a similar congress in London towards the end of June next year. Group Captain H. R. H. the Duke of York, K. G., G. C. V. O., R. A. F., has consented to become President of the General Council of the Congress and the Right Honourable the Lord Weir of Eastwood, P. C., has accepted an invitation to become a Vice-President. A strong Organizing Committee representative of all phases of British aeronautical activity, including the Air Ministry, has been formed, with His Grace the Duke of Sutherland as Chairman. This Committee is constituted as follows:—

Vice-Chairmen

Major General Sir F. H. Sykes, G. B. E., K. C. B., C. M. G.
Major General Sir W. S. Brancker, K. C. B., A. F. C.
(Director of Civil Aviation)
Lieut. Col. M. O'Gorman, C. B.
Sir Henry White-Smith, C. B. E.
Lt. Col. J. T. C. Moore-Brabazon, M. C., M. P.
Brig. Gen. P. R. C. Groves, C. B., C. M. G., D. S. O.

Members

Brig. Gen. F. L. Festing, C. B., C. M. G.
Brig. Gen. R. K. Bagnall-Wild, C. M. G., C. B. E.
Air Commodore J. M. Steel, C. M. G., C. B. E.
Air Ministry
Lt. Col. A. Ogilvie, C. B.
Mr. Griffith Brewer
Lt. Col. W. Lockwood Marsh, O. B. E.
Royal Aeronautical Society
Col. F. Lindsay Lloyd, C. M. G., C. B. E.
Lt. Col. F. K. McClean
Mr. H. E. Perrin
Royal Aero Club
Mr. C. R. Fairey
Captain P. D. Acland
Mr. Charles V. Allen
Society of British Aircraft Constructors
Mr. G. Holt Thomas
Hon. Sir Newton J. Moore, M. P.
Mr. Shirreff Hilton
Air League of the British Empire
Sir Samuel Instone
Mr. F. Handley Page
Colonel F. Searle
Air Transport
Brig. Gen. Sir F. H. Williamson, K. C. B., C. B. E.
General Post Office

General Secretary.
Mr. Charles V. Allen.

Technical Secretary.
Lt. Col. W. Lockwood Marsh, O. B. E.

The Congress will be open to all countries which are signatories of the International Air Convention, or are represented on the Federation Aeronautique Internationale; individual invitations are being issued through national committees in process of formation in each country. Membership will be divided into two classes: (a) Ordinary Members, and (b) Associate Members, comprising the families of ordinary Members, at a subscription of £1 and 10/- respectively.

According to present arrangements the Congress will occupy one week during the last fortnight in June 1923, the reading of papers alternating with visits to various aircraft factories and establishments. It is hoped that the Air Ministry will be able to arrange for the Royal Air Force Pageant to take place on the Saturday of the Congress week and that the Royal Aero Club may organize a race meeting on the Tuesday or Thursday. Monday, Wednesday and Friday will be devoted to the reading of papers, and discussions thereon, which will be divided into four or more main groups or sections which will hold simultaneous sessions in different rooms.

As the time available for the reading of papers will be limited a "Reading Committee" is to be formed, though it is hoped to arrange that the official report of the Congress to be published later shall contain a wider selection of the papers sent in. An official reception will be held in the evening of the Monday of the Congress week and the proceedings will be closed by an official banquet on the Saturday.

It is important that the Congress should not be confused with the British Air Conference called each year by the Air Ministry. The latter is of a domestic nature dealing with aeronautical matters so far as the British Empire is concerned. The Congress, on the other hand, is essentially international in character and is intended to be one of a series to be held in various countries at which experts may meet to discuss the technical and scientific development of aeronautics in all its aspects.

Organization of Aerial Mails in Argentine.

In order to develop the aviation branch of the Argentine Army and to provide at the same time an improved air service from the capitol to the smaller commercial centers, the Director of the Aeronautic Service has suggested the establishment of an aerial mail system by cooperation between the Ministry of War and the Direction General of Post Offices & Telegraphs, the Department of Commerce is advised by Vice Consul Houlahan, Buenos Aires.

The plan meets with the approval of the Ministry of War and the Postal Administration, but the latter has stipulated that the administration of the service in peace times shall be under the exclusive jurisdiction of the Post Office Department, since that branch of the government would be responsible to the public under ordinary conditions. The suggested route from Buenos Aires includes the cities of Azul, Bahia Blanca, Patagones, San Antonio Oeste, Rawson, Comodoro Rivadavia, Rio Gallegos, and Ushuaia.

A joint committee is now preparing a detailed plan, including the schedule of deliveries, time of flights, mail capacity for each trip, charges, etc.

London-Manchester Air Service

The first British air service which will connect Manchester and London by air is to be opened by the Daimler Airway very soon.

Maj.-Genl. Sir W. S. Brancker, Director of Civil Aviation, completed arrangements recently whereby the Diamler Airway will run one of their Napier-engined ten-seater expresses between London and Manchester daily in order to connect with the air services from London to the Continent.

From London to Manchester the air express will leave in the afternoon after the aeroplanes from the Continent have arrived at the London Air Station.

This new internal airway will bring Manchester within five hours of Paris and seven hours of Cologne, while in the Spring of 1923 it will be possible to fly from Manchester to Berlin and Copenhagen in the course of a day.

p. The engine burned 19.1 gallons of gas and 1.3 gallons of oil an hour at 1480 R.P.M., so was safe for thirteen and one-half hours.

q. Airplane gasoline was used except at Jacksonville, where high test gas not being available, commercial gas was used.

In 1911 and 1912 Calbraith Rodgers flew a Wright B from the Atlantic to the Pacific Coast in easy stages, taking weeks for the trip. Robert G. Fowler, one of the founders of the present L.W.F. company, flew a similar machine from the Pacific Coast east.

In 1919 the Army held its great transcontinental reliability test between New York and San Francisco, starting at both ends simultaneously on October 8, 59 planes participating. Forty-four planes left New York and fifteen left from 'Frisco. Twenty-six of the New Yorkers finished at Frisco and seven of the Californians at Mineola. Out of the total number, ten 'planes made the complete round trip, each crossing the United States twice in either direction.

In February, 1921, Alexander Pearson, 1st Lieut., Army Air Service, attempted a transcontinental flight in record time. He intended to fly from El Paso to San Antonio and then to Jacksonville, Fla., for the start westerly to the Pacific Coast. During the stage El Paso-San Antonio he got into difficulty with his engine and landed about 70 miles south of the Border and suffered many hardships in getting back to civilization and gave up the flight. About three months later a salvage expedition was sent out from Del Rio, Tex., and this found the plane intact. After installing a new engine Lieut. Doolittle the new record holder, took off and flew the Pearson machine back to Del Rio although it had been exposed to the elements all this time.

On February 21, 1921, 1st Lieut. W. D. Schey made the first fast transcontinental trip, flying easterly from Rockwell Field, San Diego, in a DH4 carrying 274 gallons of gas and 24 gallons of oil. He was forced to make a descent at Bronte, Tex. early in the morning after flying all night. Three hours later he took off and reached Dallas at about noon. Leaving here at 10:14 in the evening and made a non-stop flight to Jacksonville, Fla., arriving there February 23, after 2 days 9 hours and 24 minutes elapsed time. His flying time was 22 hours 27 minutes.

Lieut. Doolittle, tbe new record-holder, is the first white man to travel across the continent within 24 hours elapsed time. Prior to this flight he flew from Kelly Field, Texas, to Jacksonville. While here he flew up to Bolling Field, Washington, and from there to Dayton for consultation with the Engineering Division of the Air Service, and return. Other feats have been non-stop flights from Kelly Field to San Diego and back in easy stages and several times he has made non-stop flights between Kelly Field and Jacksonville.

Lieut. Doolittle has been ordered to McCook Field for study work.

Gliders, Sail-Planes, and the Peace Treaty

By Lieut. Col. A. Guidon,

Air Attache At the Italian Embassy

GLENN H. Curtiss, in a statement of the Aeronautical Chamber of Commerce, says:

"The achievement of the German Gliders may be regarded as a direct result of the restrictions imposed on Germany by the terms of the Versailles Treaty."

It can be of some interest to report a brief of discussions of the Aeronautical Interallied Commission in Paris, in 1919, when the question of such restriction arose.

The Supreme Council of the Peace Conference had requested the Aeronautical Commission to express its opinion regarding this point:

> After the Treaty of Peace and in view of the easy transformation of commercial aircraft into weapon of war will it be necessary to prohibit civilian aviation in Germany and all other Enemy States?

The Aeronautical Commission answered YES, at majority but the delegate of the United States stated:

> He was CONSIDERING all such restrictions of the entire flying activities of Germany and her Allies after the Signature of the Treaty of Peace to be NEITHER WISE NOR PRACTICABLE.

In the Report on the measures to be taken with regard to Aviation in Enemy Countries after the Treaty of Peace the American Delegation has desired to explain even more clearly its reason for: voting against certain measures which it was proposed to recommend to the Peace Conference:

> Certain of these measures could not be made a part of a Treaty concluded with the Enemy States. Some of these measures that could be inserted in the Treaty involve a measure of control after the signature of the Treaty of Peace, a control which the Conference of Peace has refused to impose.
>
> Such of these measures that could not be inserted in the Treaty of Peace involve great problems of national policy and an agreement on these points, between the Nations that have been at war with the enemy States, although desiring to invite in the other Delegations of the Commission in submitting all these measures to the Conference of Peace, it should be understood that the American Delegation does not recommend their adoption and they do not wish, in any way, to bind the United States separately or in concert with any other country to adopt any one or the whole of these measures.

As a consequence, the Treaty of Peace brought no restrictions on the Commercial Aviation; such restrictions were imposed on Germany, a long time afterwards, contrary to the precise dispositions of the Treaty of Versailles.

It is quite sure that if the Congress of the U. S. had approved the Versailles Treaty, such restrictions would never have been imposed on Germany.

Soaring Flying may not have a decisive importance in the development of aviation, but it is certainly a source of useful data for the general progress of aeronautics.

The wonderful test of the German soaring planes prove how far-seeing and right-seeing the standing of the American Delegation was, when it considered any restriction of commercial aviation NEITHER WISE NOR PRACTICAL.

FOREIGN TECHNICAL DIGEST

HANDLEY PAGE TWIN-MOTORED BIPLANE

THIS new type machine, now being used on the London-Paris Service, for carrying passengers and freight, is the outcome of experience obtained in commercial transport during the past three years with our converted war and commercial machines, and develops particularly the W. S. type machine which gained the Air Ministry's prize of £8,000 for large Aeroplanes in their trials in 1919.

SALOON

The interior of the fuselage, which is entirely free of all bracing wires, stays, struts, etc., is one large saloon, 18 feet long, fitted with 12 comfortably upholstered chairs.

Racks are provided for light luggage and a map of the route provided for in the light front of the saloon in full view of all passengers; this, together with an altitude indicator, speed indicator and clock, add greatly to the interest of the passengers in their journey.

Great care has been taken to provide adequate ventilation, free from draughts, and an excellent view is obtained in all directions, due to the large windows of Triplex Glass provided.

A well appointed lavatory is provided in the back of the saloon and a cuspidor is arranged next to each chair, which can be comfortably used in the event of air sickness. Provision is also made for carrying a fresh supply of water.

The saloon is provided with a number of emergency ripping panels in order that maximum safety and the quickest exit is obtainable in the event of such being necessary. A door leads through the forward freight compartment to the pilot's cockpit in the event of communication being desirable in flight.

FREIGHT

Freight is carried in two separate compartments, each capable of carrying 6 cwt., one forward between the saloon and pilot's cockpit, 80 c. ft., the other, 90 c. ft., being immediately aft of the saloon. Each is provided with a separate door, so that the passengers are not inconvenienced by the loading of freight.

LOAD CARRIED

Weight light (with water)	7,260 lbs.
Pilot	160 "
Mechanic	
Petrol for 3¼ hours (137 gallons)	1,000 "
Oil (10 gallons)	100 "
Passengers (at 180 lbs.) (12)	2,160 "
Cargo	1,820 "
	12,500 lbs.

Note: It is not considered necessary that a mechanic should be carried under normal conditions.

PERFORMANCE

The certified performance is:—

With Load	12,500 lbs.	11,500 lbs.
Maximum speed at 1,000 ft........	96 m.p.h.	101 m.p.h.
Ground rate climb	370 ft/min.	425 ft/min.
Service ceiling..	7,500 feet.	8,700 feet.
Landing speed...	44 m.p.h.	42 m.p.h.
Run to "get off".	320 yards.	300 yards.
Run to "pull up".	240 yards.	240 yards.

RELIABILITY

By the use of twin engines greater reliability is obtained in the machine than that which is possible with a single engine, as each engine is independent of the other in the event of a breakdown and the machine is proved capable of flying on the remaining engine.

Great attention has been paid in order to obtain a slow landing speed, which is an absolute necessity for safety.

The pilot, seated in the extreme front of the aeroplane, has an entirely uninterrupted view. A seat is provided by the side of the pilot in case it is required to carry a mechanic or navigator for special purposes.

A Marconi system of Wireless Telegraphy is fitted for the use of the pilot, and a "listening in" set is provided in the saloon for the benefit of the passengers.

EQUIPMENT

The following equipment is fitted:—

Wireless Telegraph Apparatus (Civil type)
2 Air Speed Indicators (One in Cabin)
2 Altimeters. (One in Cabin)
Lateral Clinometer.
2 Revolution Indicators.
2 Radiator Thermometers.
2 Oil Pressure Gauges.
2 Petrol Level Gauges.
2 Oil Temperature Thermometers.
1 Watch and Holder.
1 Instrument Lighting Set.
3 Pyrene Fire Extinguishers (Two in Cabin)
1 Pilot's Belt.
1 Compass.
1 Turning Indicator.

COST OF UPKEEP

Each engine is provided with a separate petrol tank which is fixed on the top plane, so that the usual power petrol pumps are dispensed with, as also the emergency hand pump and all the attendant piping, gauges and control cocks.

On account of the very large number of Rolls-Royce engine spare parts obtainable at economic prices, the engine upkeep is of particularly low cost.

The location of the engine is such that no cowling is necessary, and this fact, combined with their positioning, makes the dismantling for overhaul a very simple and quick operation.

ALTERNATIVE ENGINE

Napier "Lion" Engines of 450 H. P. may be fitted in this type machine, without any increase in weight, and the performance

Maximum speed at ground.. 120 m.p.h.

increased to:—

Rate of climb at ground... 750 ft/min.
Service Ceiling.............. 12,000 ft.
Landing speed................ 44 m.p.h.

The Handley-Page Biplane of the Type Used in the Cross-Channel Passenger Service.

THE NEW SIEMENS-HALSKE AERO ENGINE

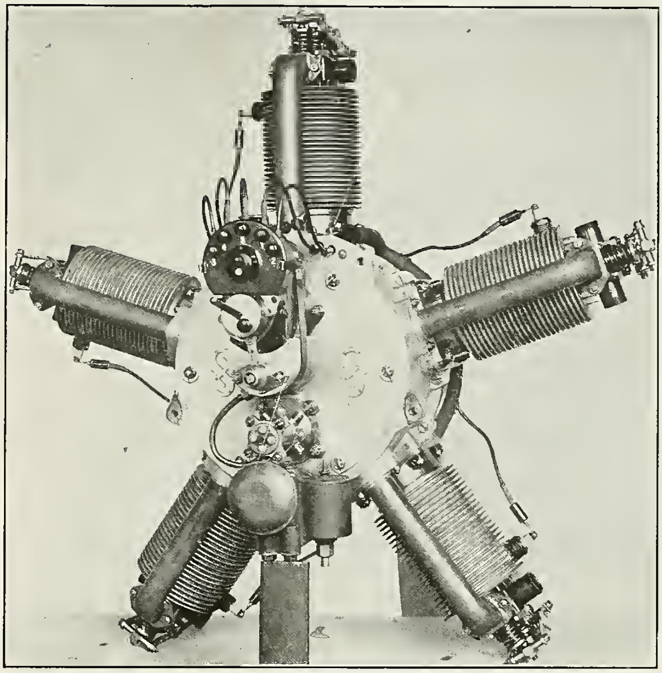
THE note of allies on the 14th of April 1922 making determinations to the German Aircraft Industry says in rule I:

"Every one seater-aeroplane with a greater performance than 60 h. p. is taken for a military object and therefore as implement of war."

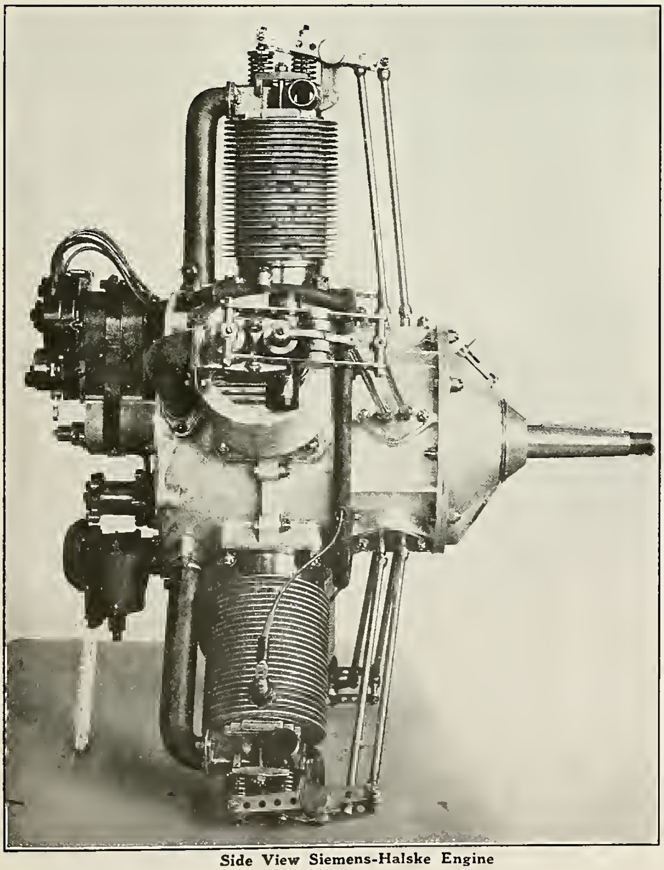
Consequently German aircraft works have built very interesting new aero engines and aeroplanes.

The new Siemens-Halske aero engine is shaped as a star-motor with 5 fixed cylinders.

It is a four stroke engine with air cooling. Its bore is 4" and its stroke 4,7". The crank shaft, constructed in highly valute material, consists of two parts with ball bearings, laid in the split aluminum crank shaft chamber in bronze bushes. On the main connecting rod, likewise running on ball bearings, the secondary connecting rods are joined. The cylinders are made of steel with aluminium mantles furnished with ribs for air cooling. The pistons are made of aluminum. On the cylinders there are placed the inlet and the exhaust valve chambers. The inlet and the exhaust valves are mechanically operated by thrusting poles.



Rear View Siemens-Halske Engine



Side View Siemens-Halske Engine

The opening and closing of valves is done by tipping arms lying into each other. They are laid down in the case of exhaust valve, and the axle of which is in ball bearings. The trusting poles are operated by tappets, gliding in guides easily to be changed and operated by a cam, corresponding with the gear times of the motor. Toothed wheels lying in the forepart of the crank shaft chamber with gear ratio corresponding to the valves-operation, drive on the came, going in ball bearings. A cover of cast aluminum shuts the forepart of the crank shaft chamber. In this cover there is in a casted bronze bush the strong ball thrust bearing for accepting the shear in the axe.

In the back part of crank shaft chamber there is the suction passage for the explosive gas mixture, conducted to the inlet valves by sucking tubes easily to be taken of from a special carburetor. An air pump driven by the crank shaft by means of eccentric keeps the pressure constantly when the petrol tank is at the bottom. This pressure takes care of conducting the fuel to the carburetor. At the back close cover of the crank shaft chamber there is one high tension ignition device driven by tooth-wheels. The ignition device is secured in its position by fitting pins and kept on the bad plate by a spaning band easily to be untied. The cables are put in a pipe. Each of the five cylinders has a sparking plug. There can also be connected two magnetic devices and then each cylinder receives two separated sparking plugs. An oil pump likewise arranged at the back cover takes the oil through the hollow crank shaft to the engine parts that

(*Concluded on page* 571)

Publications and Technical Notes of the National Advisory Committee for Aeronautics

IN entering upon its eighth year of work, the National Advisory Committee for Aeronautics, established by an act of Congress in March, 1915, has inaugurated one of the most productive methods of research yet devised for the solution of original problems. The towing of full-sized surfaces in the air and the development of the new instruments which record photographically during actual flight the speed through the air, the variations in loading on the wings in flight and on landing or taking off, control positions and others, carry the battle of research far into the enemy's country.

All the results of the research work of the Committee are available in either printed or mimeographed form. Following is a list of the *printed* annual and separate reports. This list will be found invaluable to students, constructors, operators, users and libraries throughout the country. It is the aim of *Aerial Age to* furnish its readers with the world's aeronautical information, either directly or indirectly.

The annual reports of the National Advisory Committee for Aeronautics contain all technical reports prepared by this Committee. The technical reports are also published separately unless otherwise indicated. Those marked with an asterisk (*) are not obtainable as separate reports but are available only in the annual reports. *All reports may be had on application to the Superintendent of Documents, Government Printing Office, Washington, D. C.,* which should be accompanied by remittance in the form of coupons, postal money order, express money order, New York draft, or certified check. If currency is sent, it will be at sender's risk. Foreign orders should be accompanied by international money order or New York draft. Postage stamps, coins defaced or worn smooth, foreign money, and uncertified checks will not be accepted.

First Annual Report (1915)

The First Annual Report Contains Reports Nos. 1 to 7. Price is $ .35

No.

*1 REPORT ON BEHAVIOR OF AIRPLANES IN GUSTS.
Part 1. Experimental Analysis of Inherent Longtitudinal Stability for a Typical Biplane.
By J. C. Hunsaker.
Part 2. Theory of an Airplane Encountering Gusts.
By E. B. Wilson.

*2 INVESTIGATION OF PITOT TUBES.
Part 1. The Pitot Tube and Other Anemometers for Airplanes.
By W. H. Herschel.
Part 2. The Theory of the Pitot and Venturi Tubes.
By E. Buckingham.

*3 REPORT ON THE INVESTIGATIONS OF AVIATION WIRES AND CABLES, THEIR FASTENINGS AND TERMINAL CONNECTIONS.
By John A. Roebling's Sons Company.

*4 PRELIMINARY REPORT ON THE PROBLEM OF THE ATMOSPHERE IN RELATION TO AERONAUTICS.
By Prof. Charles F. Marvin.

*5 RELATIVE WORTH OF IMPROVEMENTS ON FABRICS.
By the Goodyear Tire and Rubber Company.

*6 INVESTIGATIONS OF BALLOON AND AIRPLANE FABRICS.
Part 1. Balloon and Airplane Fabrics.
By Willis A. Gibbons and Omar H. Smith.
Part 2. Skin Friction of Various Surfaces in Air.
By Willis A. Gibbons.

*7 THERMODYNAMIC EFFICIENCY OF PRESENT TYPES OF INTERNAL COMBUSTION ENGINES FOR AIRCRAFT.
By Columbia University.
Part 1. Review of the Development of Engines Suitable for Aeronautical Service.
Part 2. Aero Engines Analyzed with Reference to Elements of Process or Function.

Second Annual Report (1916)

This Report Contains Reports Nos. 8 to 12. Price $1.25. It is regrettable that this volume is out of print.

*8 GENERAL SPECIFICATIONS COVERING REQUIREMENTS OF AERONAUTICAL INSTRUMENTS.
By the National Advisory Committee for Aeronautics.

*9 NOMENCLATURE FOR AERONAUTICS.
By the National Advisory Committee for Aeronautics.

*10 MUFFLERS FOR AERONAUTICAL ENGINES.
By Professor H. Diederichs and Professor G. B. Upton.

*11 CARBURETOR DESIGN—A PRELIMINARY STUDY OF THE STATE OF THE ART.
By Charles Edward Lucke, Assisted by Friederich Otto Willhofft.

*12 EXPERIMENTAL RESEARCHES ON THE RESISTANCE OF AIR.
By L. Marchis.

Third Annual Report (1917)

This volume contains Reports Nos. 13 to 23. Price $1.50

13 METEOROLOGY AND AERONAUTICS.
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Part 1. Physical Properties and Dynamics of the Atmosphere.
Part 2. Topographic and Climatic Factors in Relation to Aeronautics.
Part 3. Current Meteorology and its Use.

*14 EXPERIMENTAL RESEARCH ON AIR PROPELLERS.
By Wm. F. Durand.
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Part 2. Tests on 48 Model Forms of Air Propellers, with Analysis and discussion of Results and Presentation of the Same in Graphic Form.
Part 3. A Brief Discussion of the Law of Similitude as Affecting the Relation between the Results Derived from Model Forms and Those to be Anticipated from Full-sized forms.

*15 NOMENCLATURE FOR AERONAUTICS.
By the National Advisory Committee for Aeronautics. (5)

*16 THE STRETCHING OF THE FABRIC AND THE DEFORMATION OF THE ENVELOPE IN NON-RIGID BALLOONS.
Part 1. The Stretching of the Fabric and the shape of the Envelope.
By Rudolph Hass.
Part 2. The Deformation of the Envelope of the Siemens-Schuckert Airships.
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Part 2. Balloon Fabrics.

*23 AERONAUTIC POWER PLANT INVESTIGATIONS.
By the Subcommittee on Power Plants.
Part 1. Performance of Aeronautic Engines at High Altitudes.
Part 2. Radiator Design.
Part 3. Spark Plugs.

Fourth Annual Report. (1918)

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*24 AIR FLOW THROUGH POPPET VALVES.
By G. W. Lewis and E. M. Nutting (5c)

*25 NOMENCLATURE FOR AERONAUTICS.
By National Advisory Committee for Aeronautics. (5c)

*26 THE VARIATION OF YAWING MOMENT DUE TO ROLLING.
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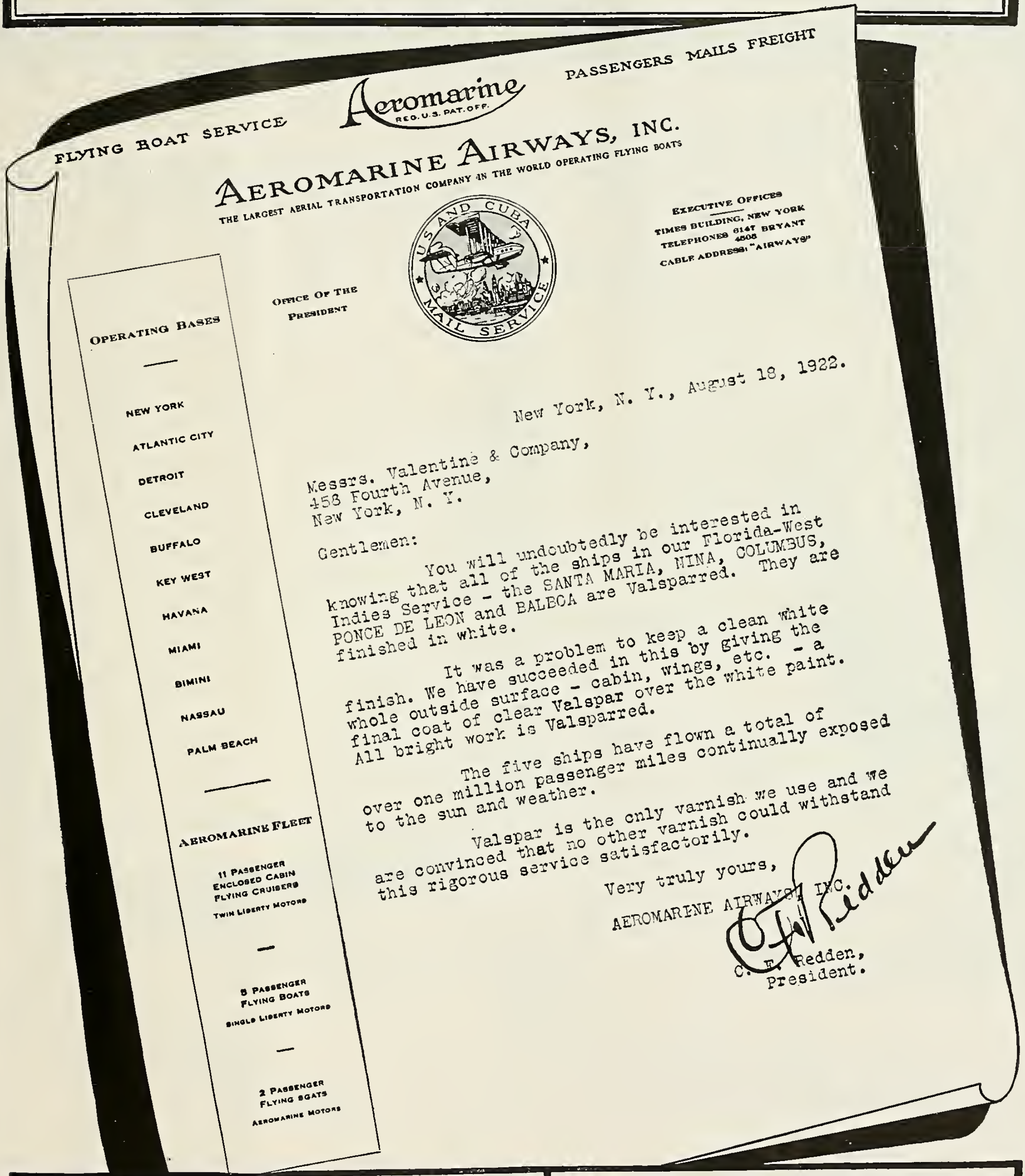
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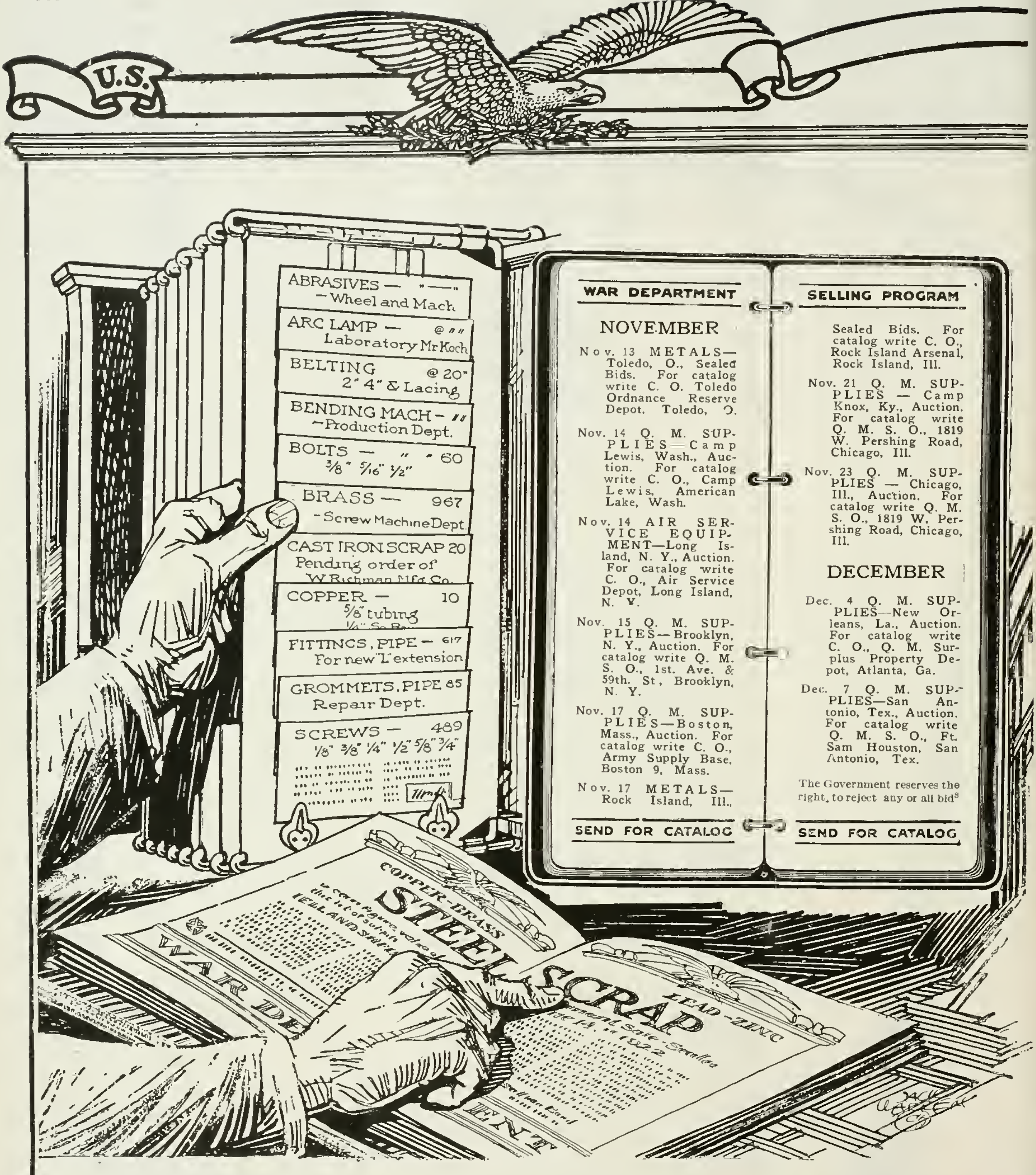

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Nov. 14 Q. M. SUPPLIES—Camp Lewis, Wash., Auction. For catalog write C. O., Camp Lewis, American Lake, Wash.

Nov. 14 AIR SERVICE EQUIPMENT—Long Island, N. Y., Auction. For catalog write C. O., Air Service Depot, Long Island, N. Y.

Nov. 15 Q. M. SUPPLIES—Brooklyn, N. Y., Auction. For catalog write Q. M. S. O., 1st. Ave. & 59th. St, Brooklyn, N. Y.

Nov. 17 Q. M. SUPPLIES—Boston, Mass., Auction. For catalog write C. O., Army Supply Base, Boston 9, Mass.

Nov. 17 METALS—Rock Island, Ill., Sealed Bids. For catalog write C. O., Rock Island Arsenal, Rock Island, Ill.

Nov. 21 Q. M. SUPPLIES — Camp Knox, Ky., Auction. For catalog write Q. M. S. O., 1819 W. Pershing Road, Chicago, Ill.

Nov. 23 Q. M. SUPPLIES — Chicago, Ill., Auction. For catalog write Q. M. S. O., 1819 W. Pershing Road, Chicago, Ill.

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Dec. 4 Q. M. SUPPLIES—New Orleans, La., Auction. For catalog write C. O., Q. M. Surplus Property Depot, Atlanta, Ga.

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(Concluded from page 566)

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(Concluded from page 539)

In any particular case for which the performance is known, the formula is quite accurate in predicting the effect of small changes in W., B. H. P., or S. To do this, Equation (2a) is solved for the exact value of K by substitution of the original data and this value is used with the new values of $\left(\frac{W}{HP}\right)$ or $\left(\frac{W}{S}\right)$ to obtain the new ceiling.

The absolute ceiling for any common values of $\left(\frac{W}{HP}\right)$ and $\left(\frac{W}{S}\right)$ may be read directly from Fig. 1 which is based on Equation (2a) with K = 19000.

Table 1.
Value of constant K in

$$H = K \log_{10} \frac{10000}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)}$$

Aeroplanes	$\left(\frac{W}{HP}\right)$	$\left(\frac{W}{S}\right)$	H	K	Remarks
JN-4D......	22.6	5.72	9250	17300	Landplane
DH-4........	11.20	7.62	19200	19800	"
VE-7........	11.60	7.36	18900	19200	"
MB-3........	7.00	8.4	25500	18400	"
M-80........	8.80	12.3	19900	19500	"
Nieuport "Night-hawk".....	6.60	7.77	29000	19800	"
Fokker D-VII.....	8.47	8.36	25000	20400	"
Mrtinsyde Scout......	7.50	6.95	26800	19000	"
N9-H........	18.30	5.54	14500	19500	Flt. seaplane
R-9L........	10.9	7.10	20000	18500	"
HA-2........	10.40	8.00	20500	19200	"
F-5-L........	18.10	9.30	9500	18500	Boat seap'ne
DT-1........	17.20	9.75	10200	19000	"
NC-5........	21.30	9.70	6000	17000	"

(Concluded from page 563)

are to be oiled and sucks the superfluous oil out the motor and represses it to the oil tank.

The motor is hanged up by means of eyes casted on the back part of the crank shaft chamber, whereby the border of the back close-cover serves as centring.

The aero engine will be built with 5 cylinders, 50/55 h. p. for one seater aeroplanes and with 7 cylinders, 80/85 h. p. or 9 cylinders, 100/110 h. p. for other aeroplanes.

The weight of the 50 h. p. motor in running order is about 93 kg. the consumption of fuel, about 260-280 g/h. p. and the consumption of oil about 8-10 g/h. p.

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Avros and Thomas Morse scouts also.	

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Before me, a Notary Public in and for the State and county aforesaid, personally appeared G. Douglas Wardrop, who, having been duly sworn according to law, deposes and says that he is the Editor of the Aerial Age and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher: Aerial Age Co., Inc., 5942 Grand Central Terminal, New York. Editor: G. Douglas Wardrop, 5942 Grand Central Terminal, New York. Managing Editor: None. Business Manager: G. Douglas Wardrop, 5942 Grand Central Terminal, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

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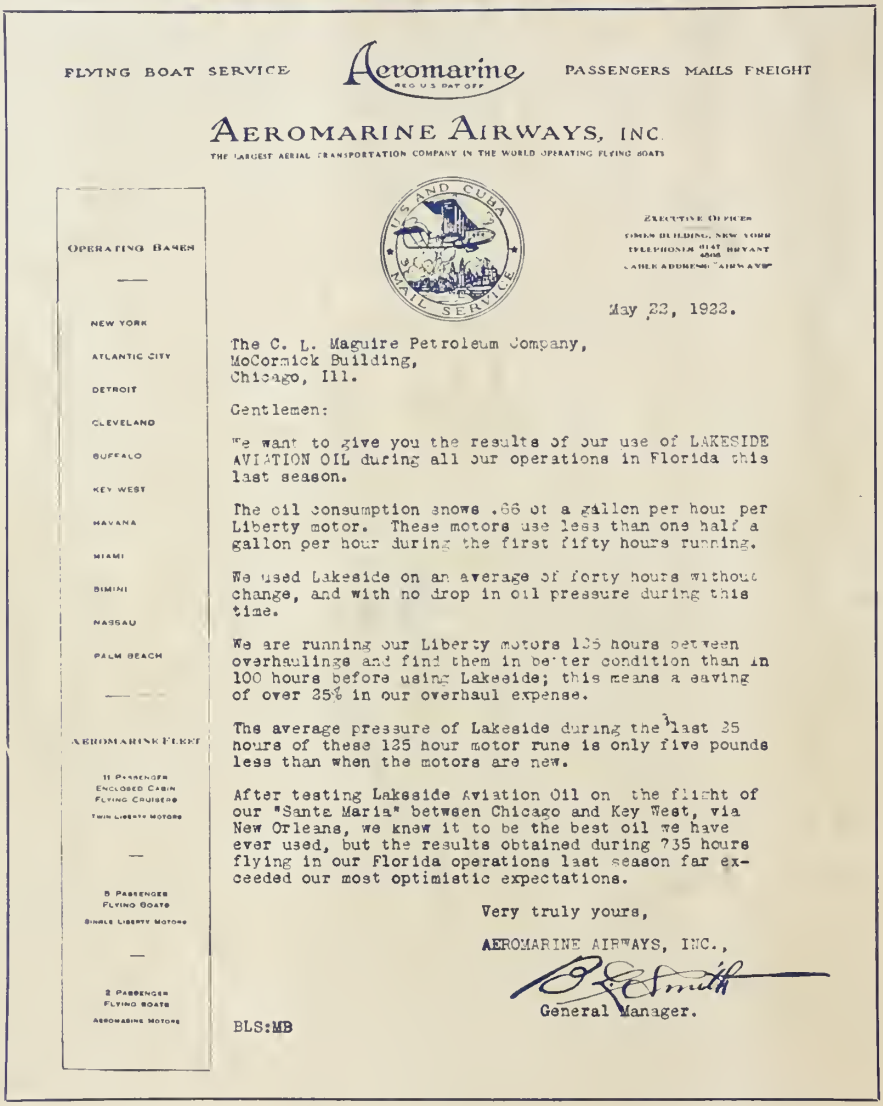

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PUBLISHED MONTHLY BY THE AERIAL AGE COMPANY, Inc., 5942 GRAND CENTRAL TERMINAL, NEW YORK CITY
Subscription: Domestic, $3; Foreign, $5. Entered as second class matter, March 25, 1915, at the Post Office at N. Y. under the Act of March 3rd 1879; also entered on September 22, 1922 at the Post Office at Bethlehem, Pa.

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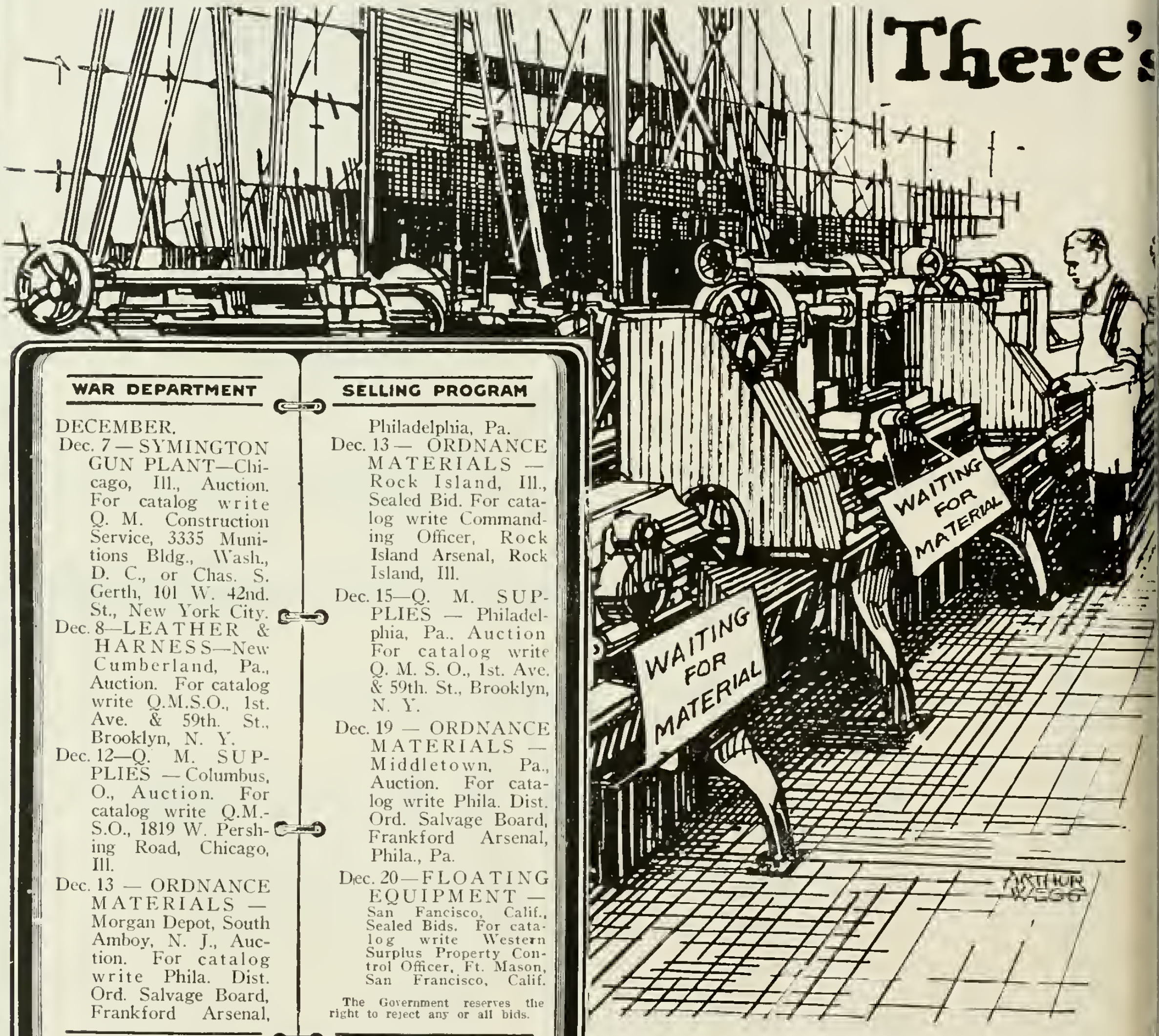

WAR DEPARTMENT **SELLING PROGRAM**

DECEMBER.

Dec. 7 — SYMINGTON GUN PLANT—Chicago, Ill., Auction. For catalog write Q. M. Construction Service, 3335 Munitions Bldg., Wash., D. C., or Chas. S. Gerth, 101 W. 42nd. St., New York City.

Dec. 8—LEATHER & HARNESS—New Cumberland, Pa., Auction. For catalog write Q.M.S.O., 1st. Ave. & 59th. St., Brooklyn, N. Y.

Dec. 12—Q. M. SUPPLIES —Columbus, O., Auction. For catalog write Q.M.-S.O., 1819 W. Pershing Road, Chicago, Ill.

Dec. 13 — ORDNANCE MATERIALS — Morgan Depot, South Amboy, N. J., Auction. For catalog write Phila. Dist. Ord. Salvage Board, Frankford Arsenal, Philadelphia, Pa.

Dec. 13 — ORDNANCE MATERIALS — Rock Island, Ill., Sealed Bid. For catalog write Commanding Officer, Rock Island Arsenal, Rock Island, Ill.

Dec. 15—Q. M. SUPPLIES — Philadelphia, Pa., Auction For catalog write Q. M. S. O., 1st. Ave. & 59th. St., Brooklyn, N. Y.

Dec. 19 — ORDNANCE MATERIALS — Middletown, Pa., Auction. For catalog write Phila. Dist. Ord. Salvage Board, Frankford Arsenal, Phila., Pa.

Dec. 20—FLOATING EQUIPMENT — San Fancisco, Calif., Sealed Bids. For catalog write Western Surplus Property Control Officer, Ft. Mason, San Francisco, Calif.

The Government reserves the right to reject any or all bids.

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Note:—Sale of Sodium Nitrate, approximately 25,000 short tons, located at Jacksonville, Tenn., will be held by Sealed bids, closing 12 o'clock noon, December 15, 1922. For information and proposal form, address District Ordnance Salvage Board, Room 808, Army Bldg., 39 Whitehall St., New York City, N. Y.

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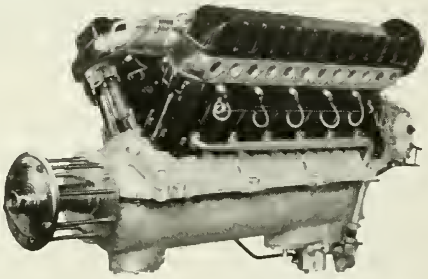

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The Loening Air Yacht in Flight

New York to Detroit via the Air-Water Route

This Story Was Written By a Woman Passenger on the Flight Described

SUCH a day! And such a Ship! Like a great throbbing bird our perfectly timed Liberty purred a welcome as we climbed aboard at Port Washington at 1:06 P. M. on Thursday, 31 August. Slowly and gently the waters of Long Island Sound slipped away as we rose to a two thousand foot level and banked onto our course, headed for the blue waters of the Hudson. New York with its lofty buildings and dejected tenements soon was lost to view as the majestic Palisades guided us on our way up the wonderful river they so silently guard.

Approaching the hills near West Point we gradually increased our altitude to three thousand feet, flying in this position until after leaving Poughkeepsie, when we came down to within one hundred feet of the river. As we were nearing Albany, we sighted a New York Central train, bound for Chicago, and though it was travelling at a high rate of speed, it could not compete with our "Loening" and soon it was lost to view.

We landed at the Albany Yacht Club at 2:32 P. M. just 1 hour, 26 minutes after leaving New York. After replenishing with gasoline we were again on our way, rising at once to an elevation of 5,000 feet in order to have a good altitude to cross over Glen Falls. We passed many beautiful lakes and hills but our real treat came when we sighted beautiful Lake George lying so peacefully in the heart of the Adirondacks. After viewing the beautiful panorama spread before us one can easily appreciate why this is called "America's Playground of the Alps". We landed at the south end of the lake to take on more gasoline and incidentally a sandwich for ourselves.

We hated to leave such a beautiful spot and only the necessity of making distance pulled us away. The passing landscape as we flew over Lakes George and Champlain was very picturesque; the Green Mountains of Vermont to our right and rolling farm lands to our left, dotted here and there with small lakes and towns made the picture complete. We passed a moss-covered fort, apparently in good condition, but were unable to determine its name.

After leaving Lake Champlain we followed the Richelieu River and as we reached the St. Lawrence River, we thought it wise to stop at St. Charles, Richelieu, for more gas. This was the first ship to make a landing at this town and if Pegasus, himself, had swept down upon them, I don't think they would have been more surprised. The entire population was down at the dock to give us a super-cordial welcome. His Royal Highness, himself, could not have been treated with more prominence. Unfortunately, none of us could speak their language but a little girl acted as interpreter and we were extended every courtesy possible.

We left St. Charles at 7:37 P. M., flying north over the river to a point probably twenty-five miles north of Montreal where we crossed over to the St. Lawrence River and then turned south, passing over Montreal at 8:08 P. M. and gliding into the canal at Lachine, as the last ray of light was slipping beyond the horizon. Our actual flying time from New York was four hours, twenty-three minutes. When our ship was safely moored we motored to a hotel in Montreal where we did justice to a real steak with all of its appurtenances.

Thus ended the first day of our journey for all except our sturdy pilot. He, who had guided us over rivers, lakes and mountains without one slip of the control and who had earned a night's repose was awakened in the wee small hours by a loud knocking on his door and two men entered uninvited, one an Assistant Manager of the hotel, the other Police Sergeant LaPorte. They turned on the light and at once began to put our pilot through the third degree, but when they found out we were just travellers with no ulterior motive other than to get our ship, as well as ourselves, safely to Detroit, they left, apparently satisfied.

The next morning we awakened to find a bright sun and a blue sky to tempt us to continue our flying, but to leave such a romantic city without seeing at least a few of its magic spots seemed criminal, so we decided to defer our leaving until later in the day and spend a few hours sightseeing. As we strolled down the main street we saw many sights of interest, some amusing. The over-dressed American tourists were quite a contrast to the Canadians in walking shoes and knickers, sauntering along, pointing with their canes to objects of mere significance. We hired an automobile to take us to Mount Royal. This was a most delightful ride and from the mountain top we were able to get a good view of the City and the adjacent country. We returned to our hotel late in the afternoon and as the "call of the air" was so prevalent in all of us, we decided to take a short hop before dinner.

We left the Montreal Boat Builders Dock at 5:42 P. M. and as we had fourteen miles of rapids to cross we climbed at once to 2200 feet. After passing Ogdonsburg, New York, we came down to one hundred feet above the water so as to give us a good view of the beautiful Thousand Islands which we were nearing.

Looking over the blue expanse of the waters of the Islands we turned our thoughts back in the dim vista of the ages and tried to visualize this region in its undeveloped natural condition, as it was when inhabited by the Iroquois and Algonquins—when wigwams and dense forests stood in the place of stately mansions and landscaped gardens, and birch-bark canoes traversed the rivers instead of luxuriant yachts. It is then we realize how Longfellow was inspired to write his beautiful poem "Hiawatha". It would bankrupt the English language to describe the virtues of the Thousand Isles. Only by seeing can one appreciate its beauty and know why it is the chosen mecca for tourists as well as the summer playground for our country's most prominent people.

We landed at Alexandria Bay, the Hub of the Thousand Islands, at 7:20 P. M., our flying time from Montreal being 1 hour, 34 minutes.

The next morning after a short walk around the bay, we resumed our journey. We had twenty minutes of flying over the Islands before we left the river to follow the southern shore of Lake Ontario. The air was very rough so after flying one hour and a half we landed at Sodus Point for luncheon and to wait for the wind to subside.

When we started again at 4:35 P. M. we began at once to climb and by the time we reached the Niagara River we had attained an altitude of 5200 feet. I think we had our greatest thrill at this point as we knew that soon we would experience a few minutes of tricky flying.

We passed over Niagara Falls at 6:11 P. M. at an elevation of 4700 feet. The visibility was perfect and we had a wonderful view of the Falls and Rapids from this altitude. When the treacherous waters were passed we began to gradually descend and landed at the Buffalo Yacht Club at 6:20 P. M.

We spent the night in Buffalo and most of the following day the weather was not conducive to safe flying. In the afternoon the rain ceased and the sun began to shine, so we left our mooring at 4:17 P. M., headed for Lake Erie and home. Flying along the north shore of the lake we passed Port Carbone and Welland Canal at an elevation of 1400 feet. When we reached Rondeau Harbor we had to land for gasoline and as it had to be carried some distance it took considerable time, and we were forced to stay all night. There is no hotel there, but we were taken in by some very hospitable Detroit people and spent a very enjoyable evening.

We left Rondeau Harbor at 9:04 the next morning, following the Lake Shore to the Detroit River. Bois Blanc Island and Grosse Isle were sighted and we then knew our wonderful journey was fast coming to an end. Owing to the perfect visibility, we had an excellent view of the City and after circling around Belle Island we landed at the Detroit Yacht Club at 10:25 A. M. The actual flying time from New York to Detroit via the water route was 12 hours and 8 minutes.

A trip in a Leoning Aero Yacht is always a pleasure but when it takes one over an ever-changing panorama of the most beautiful scenery in the world, it is a delight which will linger in the memory forever.

The Airplane Carrier Langley

OF the three new types of ships of the U. S. Navy, the new battleships, authorized in the 1916 program and the largest and most powerful in the world, the fleet submarines and the steel airplane carrier ship "Langely," the latter is obviously of first importance to the aeronautical world.

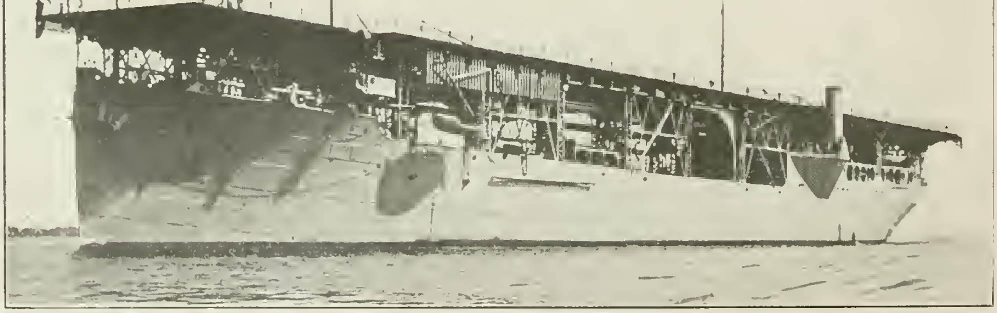
This last vessel is the old collier "Jupiter," remodeled until her original designers could scarcely recognize her. She was launched in 1912 and was as novel then as now for she was the first to be driven by electric turbines of 7152 horsepower. Placed out of commission as a collier on May 24, 1920, she has been refitted at the Norfolk, Va., Navy Yard, for her new role.

Her present characteristics are as follows:

Length between perpendiculars	520 ft.
Length overall	542 ft.
Beam	65 ft.
Speed about	15 knots
Displacement about	12,700 knots
Corresponding draft about	18 ft. 10.5 ins.
Gasoline capacity	578 tons
Fuel oil capacity	2000 tons
Officers	45
Aircraft mechanics	45
Crew	229
Guns on lower deck,	four of 5 inch
Depth of hold	36 ft. 9 ins.

All of the coal handling gear has been removed and in its place has been erected a flying deck, located about 56 feet above the water line, extending from bow to stern, a length of about 525 feet and a width amidships of about 65 feet. This deck is flush all over, and makes an ideal floating aerodrome.

A huge electric elevator, normally flush with the flying deck, 47 feet by 36 feet,



The Airplane Carrier Langley

hoists the 'planes from assemblage space on the main deck or from the hold. Forward of the elevator is a "palisade" of channel steel, normally flush with the deck, capable of being raised about 10 ft. up across the deck and on two sides to provide a wind break for protection to the airplanes while being assembled or handled on the flying deck.

Five ton jib cranes, with large outreach, one on each side of the vessel, can hoist seaplanes out of the water and land them on the hangar deck, the deck next below the flying deck. Beneath the flying deck forward and aft of the elevator are electric traveling cranes of five ton capacity provided for hoisting 'planes out of the hold and for transferring them fore and aft to the shop spaces and elevator. Shop facilities for repairing include: machine shop, wing repair shop, molding shop, metal shop, store rooms, blacksmith shop, armory, foundry, torpedo repair shop, photograph laboratory.

While open hangar space is provided between the main and flying decks, hold spaces are arranged for the stowage of aircraft and accessories, aircraft ammunition, fuel oil, gasoline and stores.

Quarters include accommodations for the ship's own complement and the officers and enlisted personnel assigned to the care and operation of the airplanes. In addition to berthing spaces the quarters include hospital, laundry, butcher shop, bread room, general mess pantry, general issuing room, food service room, etc.

Forward of the forward mast is a trapdoor lookout for the use of officers in charge of operation and control of activities on the flying deck, to note the course of the vessel, give signals and observe the approaching airplanes.

The two 54-foot masts, one each forward and aft, are made to telescope and disappear entirely below the flying deck. These are used for the main or long distance radio antennae, which are quickly stowed when the masts are housed. Raising or lowering the masts and antennae is done in the minimum of time. Antennae for short distance communication with shore stations or with other ships are suspended horizontally along the two sides of the ship from booms.

The navigating bridge on the bow will be noticed below the flying-off deck.

An elaborate system of gasoline and oil distribution has been installed. At each side of the ship near the aft mainmast respectively is a gasoline and lubricating oil station. Two of each on either side are provided further forward in close proximity to the palisade. A gas distributing pump is used to distribute the gasoline to four service tanks. At each service tank is a small service pump to further distribute the gasoline to the filling stations which are provided as above. The gasoline and oil to be stowed total 578 and 90 tons respectively. The oil is distributed in a manner similar to that of the gasoline. Provision is made for heating the main oil tanks and service tanks, the latter to a temperature of about 130 degrees F.

A platform for testing airplane engines with propellers in place will accommodate the largest airplane yet contemplated.

In the stern, just under the flying deck, is a pigeon loft and between it and the rear mainmast is a balloon-filling station for use with hydrogen or helium gas compressed in tanks.

The smoke pipes are arranged so as not to obstruct the flying-off deck and to keep smoke clear of the deck. This is accomplished by providing a short smoke stack on each side clear of the flying deck. The branches are interconnected so that the smoke may be discharged always on the lee side. One of the smoke pipes is arranged to hinge downward when it is considered necessary to discharge the smoke near the water, while the other can discharge the smoke downward through a water spray.

A flooding and sprinkling system is provided for airplane ammunition spaces and especial attention has been given to ventilation. A fire extinguishing system using steam for smothering is also provided for all hold compartments containing airplanes, gasoline tanks and oil tanks and compartments adjacent thereto. A water fire protection system also extends to other positions on the flying-off deck, with fire hose for the fire plugs while additional foam fire extinguishers are also considered necessary.

There are berths for the Captain and 9 officers of the ship, 35 flyer officers and 45 chief petty officers (aviation mechanics) and a crew of 229.

Around the flying-off deck is a rail supporting a life net, which is arranged to hinge down and outboard so that the deck can be readily cleared of all obstructions. This life net may be laid down in sections, clearing a part of the deck at a time, if desired. Portable stanchions and chains surround the elevator well when the elevator is down.

A masthead anemometer is electrically connected to the pilot house, to the flight officers' office or elsewhere. Voice tubes are arranged at suitable points.

Near the mainmast is a radio compass house, arranged to raise up from a position flush with the flying-off deck.

National Aeronautic Association Organized for the Advancement of American Aeronautics

THERE was organized and incorporated at Detroit, Mich., October 12-14, 1922, a new national body by 379 delegates from nine districts of the United States corresponding to the Army Corps Areas, under circumstances vastly more auspicious than any of the earlier efforts at a truly national organization.

It may be remembered that a number of years ago some of the more active members of the Aero Club of America, in co-operation with a number of dissatisfied affiliated clubs, attempted to form a national body, truly national in scope in spirit. This failed through the promotion by the Aero Club itself of an alleged national body, which infant later succumbed to some child's disease.

Just before the War, Howard E. Coffin interested himself in attempting to amalgamate the Aeronautic Society (New York) and the Aero Club of America into an Aeronautical Institute. Factions in the Aero Club at that time, later eliminated, prevented the fulfillment of this idea.

Just after the war, returning pilots formed the American Flying Club in New York which was joined with the Aero Club of America in 1920. In the Fall of 1921, during the flying meet at Omaha, there was formed the National Air Association, with Sidney D. Waldon as President and Rex L. Uden, of Cleveland, as Secretary.

This was a preliminary attempt to enlist all the aeronautic interests of the country into one big union and it was expected to complete the job at the second congress in 1922. During the ensuing months Colonel H. E. Hartney, secretary of the advance committee, organized an advance committee and, stirred up many cities to the formation of air boards. This advance committee was composed of five hundred enthusiasts, and of these an executive committee of thirty carried on the active work culminating in the convention just held during the flying race meet at Detroit.

It is assumed that eventually the national association would naturally become, in place of the Aero Club of America, the American member of the Federation Aeronautique Internationale. The Aero Club of America, practically since its inception, has been the body officially representing America in world aeronautics through its membership in the F. A. I.

The new Association was incorporated October 14th, 1922, as a non-profit, membership corporation, the papers being dispatched from Detroit to Hartford, Connecticut, by airplane and incorporation completed on the day of adjournment of the Congress. The control is in the hands of 23 governors, of whom each district is represented by two, with 5 governors-at-large.

Officers elected were as follows: Howard E. Coffin, President, Detroit, Mich., Bernard H. Mulvihill, Vice-President, Pittsburgh, Pa., Benjamin F. Castle, Treasurer, New York City. John B. Coleman, Recording Secretary, Sioux City, Ia. Governors elected, two from each district, were as follows:

1st District

Porter Adams, 3 Commonwealth Ave., Boston, Mass.

Godfrey Cabot, 940 Old South Building, Boston, Mass.

2nd District

John Larkin, Jr. c/o Larkin Company, Buffalo, N. Y.

Maurice Cleary, 729 7th Ave., New York City.

3rd District

L. F. Sevier, Forbes & Craig Streets, Pittsburgh, Pa.

R. J. Walters, 600 Woodbaume Street, Baltimore, Md.

4th District

Van H. Burgin, 217 Healey Building, Atlanta, Ga.

L. Sevier, President Manufacturers Association, Birmingham, Ala.

5th District

Glenn L. Martin, 16800 St. Claire Avenue, Cleveland, Ohio.

Dudley M. Outcault, Traction Building, Cincinnati, Ohio.

6th District

C. S. Rieman, 22 West Monroe Street, Chicago, Illinois.

Sidney D. Waldon, c/o Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

7th District

Ralph Cram, 216 Main Street, Davenport, Ia.

H. F. Wehrle, 503 Railway Exchange, Kansas City, Mo.

8th District

Edgar G. Tobin, 207 Augusta St., San Antonio, Texas.

William F. Long, Stinson Field, San Antonio, Texas.

9th District

P. G. Johnston, 2432 North Broadway, Seattle, Wash.

C. H. Messer, 1803 West 3rd Ave., Spokane, Wash.

Personnel of the National Headquarters has been partially selected and installed in Washington and consists at present of men in charge of Administration, Contests and Foreign Relations, Membership, Finance Legislation and Publicity. Full membership on these various committees is now being selected by the President by and with the advice of the Governors.

Mr. H. E. Hartney has been appointed Acting General Manager.

The purposes of the new Association are briefly as follows:

(a) To maintain in the headquarters of the Association in Washington an agency capable of voicing a vigorous public opinion upon beneficial and essential legislation in all matters of aeronautics;

(b) To awaken and educate the public mind to the possibilities of aeronautics, both as a vital means of national defense and as a transportation factor in the commercial development of our country;

(c) To supply an impartial medium thru which the thought of all sections of the country may be collected, collated and harmonized into a national expression of opinion;

(d) To encourage and promote the study and advancement of the science of aeronautics, and to maintain an institution which will collect and disseminate general and technical data for the development of the industry;

(e) To sanction and actively supervise under license of the Federation Aeronautique International all contests, trials, competitions and other events involving aerial craft or apparatus, and to approve all records in connection therewith.

The Governors of the Aero Club of America and the Governors of the National Air Association, the two largest aeronautical bodies in America, have already voted to merge their membership into the new association and steps are now being taken to have other smaller aero clubs and flying organizations to take similar action.

There are approximately 160 aero clubs about the country.

Thursday Evening, Oct. 12

The first meeting was called to order with H. H. Emmons, president of the Detroit Board of Commerce in the Chair, with Col. H. E. Hartney as Temporary Sec. Mr. Emmons welcomed the visitors to the rooms of the Board of Commerce and to the City of Detroit.

He likened the proposed air association to the National Automobile Chamber of Commerce and told of its need "through the reckless and improper use of air equipment at the present time."

Mr. W. P. McCracken, of the American Bar Association and a flyer, was elected permanent Chairman of the Convention.

Col. H. E. Hartney was elected permanent Sec. of the Convention.

The nine districts into which the United States is divided by the association were called upon to report their committee members appointed by the districts in caucus, as follows:

Credentials
Resolutions
Legislation
Constitution
Finance
Membership
Nomination
Permanent Rules
District Constitution

Mr. Ruter W. Springer, a Pennsylvanian and a pioneer army chaplain in aeronautics said it had been suggested "that this organization was going to be run by one interest or another. We know that it is not, but in order that the outside world may know that, I offer this resolution:

Mr. Springer reads the resolution which states that the qualifications of all governors and officers in the new association shall be shown on all records.

The resolution to refer it to the committee in By-laws was not seconded.

Mr. Mitchell, of Georgia, invited the association to hold its 1924 meeting in Atlanta. No action taken. Chicago followed with a similar invitation.

D. M. Outcault, of Ohio, was called on to give a short review of the organization of the "National Air Ass'n" at Omaha in 1921, in the absence of its president Sidney D. Waldon, of the Packard Company.

Godfrey L. Cabot, a founder member of the Aero Club of America, told of the early history of this club, and told of the Aero Club's interest in seeing this new association take over the club's former functions which were those of merely a local organization.

Colonel H. E. Hartney, the organizer of the new body, was praised for his work from the Chair and called upon. He responded by crediting H. E. Coffin, V. P. of the Hudson Motor Car Co. of Detroit with being the man "who has 'held the bag' in bringing us all together........"

Founding of American Flying Club

Col. Hartney praised the early work of the Aero Club, told of the formation of the American Flying Club, by the pilots after the war and its amalgamation with the Aero Club. "Things were not quite properly organized and the result was it began to peter out. After a while somebody suggested that we clean up the whole situation and get a new——nationalize the Aero Club of America properly." He followed with an outline of what had been done up to the present by the Advance Committee of the Association.

The announcement was made that a charter had been prepared for incorporation under the laws of the State of Conn. Motion was carried that the chairmen of the nine districts represented at the convention sign the charter as incorporators and forward it to Conn. by airplane for filing so that the Association would be a legal entity before adjourning.

On adjournment for the evening and in the morning of the following day the various committees got to work.

Meeting of Friday, 13th

Committee on Rules and Procedure reported its work in the interim, and announced its rules of procedure for the meeting, which were adopted.

Membership Committee next reported. Its report was referred to the Com. on Constitution and By-Laws. A feature of the report, was an estimate of possible strength during the first year—19,000 members, by drawing on the Chambers of Commerce, Kiwanis, Lions and Rotary Clubs.

Credential Committee next reported. Three hundred seventy-nine was found to be the number of accredited delegates to the Convention.

Financial Policy

Late Col. B. F. Castle, Chairman of the Finance Committee reported.

He recommended extreme conservatism in the expenditure of funds during the first year, which funds would be derived from membership dues, which were estimated as follows:—

275	Life members @ $500 and int.	$6875
735	Sustaining members @ $50	36850
15400	Regular members @ $5	77000
—	Organization members @ $10-$150	not estimated
—	Air Board Organization members @ $25-$150	not estimated
2730	Junior members @ $2	5460
		$126,185

Municipal "air boards" may join the Association at from $25 to $150 a year according to a sliding population scale.

Of the membership dues, the Committee believed 75 per cent, or $94,638, should go to National Headquarters, the remainder going to the District Headquarters.

Official Publication

"Another possible source of revenue" considered by the Committee was "an official publication," but the Committee recommended by the Governors take steps to insure a circulation medium for the bulletins of the Association by a connection with some publication already existing, under which there would be neither revenue nor expense.

Estimated expenditures, as figured by the Committee, are as follows:—

Salary of General Manager		$5000
Expenses (traveling, entertainment)		2000
Office salaries		2600
Organizers expenses		3500
Incidentals		2000
Multigraphing		300
Office Supplies		300
Bills Payable Nov. 1, 1922		1500
Prizes		3000
Reserve	74438.75	37219.38
Less 50%	37219.37	
Total expenditures		57419.38
Plus permanent reserve		37219.37
		$94,638.75

It was recommended the Governors be permitted to spend 50% of the reserve for expansion work.

The Committee's report was adopted.

Admiral W. F. Fullam, retired, reported as Chairman, Legislative and Policies Committee, to the effect that until the Association was actually formed it was in no position to outline policies or to formulate bills.

Safety Code

Criticism of the 31 members of the committee of the Bureau of Standards and the S. A. E. engaged in planning a safety code was made parenthetically at this point. "This saftey code is being prepared by a body which is in no way representative of aeronautics," it was claimed by a delegate. "Twenty-five members are selected from government bodies, research organizations, that are not connected with the manufacture, or operation of either aircraft, equipment or their accessories."

Mr. William J. Hammer chairman, a pioneer in the Electrical world and an expert in aeronautics, and Ruter W. Springer, Sec., reported for the Resolutions Committee. These resolutions covered the following subjects:

National policy (carried).
Urging of federal legislation for regulation civil aeronautics (carried)
Licenses for pilots (resolution laid on table)
Disapproval of Hull bill (H. R. 10967) providing for aeronautic material to be constructed in government plants. (Tabled as too drastic at this time). Endorsement of plan by which civilian contractors carry the mails. (carried).
Appreciation of the remarkable achievements of the U. S. Air Mail by the Post Office Department. (carried).
Appointment of Committee on Aeronautical Meteorology in the Association (Tabled).
Urging of Congress to make adequate appropriations for experimentation and development for military and naval aeronautics. (carried).

Committee on Constitution and By-Laws reported through Dudley M. Outcault of Cincinnati, Constitution and By-laws were read through paragraph by paragraph and adopted. Copies of these may be had upon application to the headquarters of the Association.

"Hazardous Flying"

After a discussion of a resolution putting the Association on record against wing walking and similar useless exhibition stunts, the general idea was approved in a motion.

Motion that its various engineering societies be requested to lend their active support to the work of the National Aeronautic Association was carried.

Motion thanking the Mayor of Detroit for the hospitality of the city was carried. A similar one was approved with respect to the Chamber of Commerce and the Detroit Aviation Society.

Other motions of similar nature were passed respecting the War Department, Navy Dept., Marine Corps, Post Office, Department of Commerce, N. A. C. A. State Police, and the Advance Committee on Organization, especially ex-Colonel Hartney, Sec. pro tem.

Mr. G. A., Shoemaker reported for Com. on District Constitution and By-laws in which it was recommended the districts be given the greatest powers of self government, their Constitutions and by-laws to be submitted to the Board of Governors of the national body for approval before adoption. (Carried).

Floyd J. Logan presented a number of practical suggestions for contests in 1923.

James A. Meissner, ex-major in the Air Service, an "ace", offered a resolution urging the Association exert every effort to stimulate organization of National Guard squadrons. (Carried).

Officers

John B. Coleman, of Sioux City, Ia., spoke for the Committee on Nominations and reported the candidates following were elected:

Howard E. Coffin, Detroit, Pres.
Barney H. Mulvihill, Pittsburgh, Pa., Vice-President.
Benj. F. Castle, New York, Treas.
John B. Coleman, Sioux City, Ia., Recording Sec.

Nominations for two members for the Board of Governors, one of which is to be designated as the District Vice President, were next in order and presented as previously mentioned.

After considerable discussion of Glenn Martin the nominations were passed. Mr. A. M. Harris of Cleveland, while expressing the highest regard for Martin, believed the members of the convention "will agree that it is not the thing to put any flavor of a manufacturer or aircraft corporation on to the results of this convention. There are a lot of people throughout the United States affiliated with outer organizations who have it decidedly in for the manufacturer or aircraft organizations......I believe the people at large consider him (Martin) a member of the Manufacturers Aircraft Ass'n......and I think the effect on this result from this convention would not be what we would all desire it to be......I think the best interests of Aeronautics would be best served by Mr. Martin not serving as a governor in the beginning of this Association. I thank you!"

The convention then adjourned.

N.A.C.A. Multiple Manometer

JUST what an airplane does in free flight, the degree of its stability or instability along its three axes; the position of the ailerons, elevator or rudder during any maneuver, such as a loop, spin, turn, landing or take-off; the force necessary in operating controls; the forces acting on controls in maneuvers; examination and recording of the air flow; the illustration of the properties of airplanes and the visualization of their behavior; the demonstration of the stresses undergone by an airplane in straight and acrobatic flight and how long these stresses last; and the visualization, comparison and measurement of the ability of pilots, all are recorded photographically by the instruments developed by the technical staff of the National Advisory Committee for Aeronautics. Following is the first of a series on these new instruments.

The latest of the series of novel and revealing recording instruments of the National Advisory Committee for Aeronautics for aircraft in flight maneuvers is the Multiple Manometer, which records simultaneously on a photographic film pressures at 30 different points on wing, tail, or aileron surfalls.

The instrument is placed in the observver's cockpit(Fig. 3) of a two-seater. From 60 openings 60 tubes lead to 30 capsules inserted in the two sides of the surface to be tested. The Control position recorder and the accelerometer are in operation simultaneously with the manometer.

*For complete reports on pressure distribution, obtain Nos. 118, 148, 149.

With this instrument it is possible to record pressures up to plus or minus 45 lbs. per sq. ft. for a period up to 75 secs. with the present adjustment of the capsules. Thirty differential pressures can be recorded simultaneously by this apparatus.

The principal part of the device consists of 30 separate pressure "capsules" Fig. 1 and 2. arranged around the outside of a cylindrical aluminum casting, in three rows of ten. At the center of the bottom of the case is an electric bulb with a straight vertical filament. This bulb is enclosed in a chamber having a horizontal annular slit .004 inches in width so that a horizontal sheet of light is spread out in all directions. This light is intercepted when it reaches the inside of the case by 10 long prisms which send it directly upward to 30 small prisms, which, in turn, transmit the light through lenses to a small mirror on each capsule. The beam of light is then finally reflected back through the same lens, which focuses it sharply on a film.

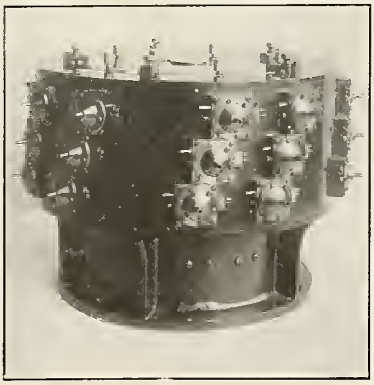


Fig. 1.

This film has a width of 4½ inches and is wound on a drum 6 inches in diameter. The film is mounted in a light tight case which can be lowered inside of the instrument between the rows of prisms and the driving mechanism. A rotary shutter opens 30 slits for the entrance of the light beam after the film drum is in place.

The film drum is turned through 1/10th revolution by a constant speed electric motor driving through a double worm reduction gear. The speed is regulated by a centrifugal governor with electric contacts which cut in and out a resistance. The speed remains constant within one per cent for considerable changes of either voltage or load.

The pressure capsule consists of a brass case divided into two chambers by a hard brass diaphragm with a connection for pressure in either part. The movement of the diaphragm rotates a small plain mirror which is mounted on pivots and in this

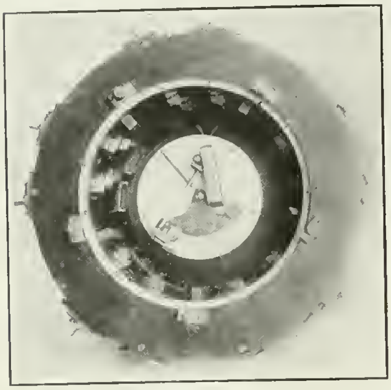


Fig. 2.

manner causes the light beam to move over the film and give the record. The moving system of the capsule is sufficiently light and well balanced to prevent any acceleration from affecting the pressure readings.

Operation

To make a record, tubes are connected to the capsules in such a manner that the pressure side is connected to the back of the capsule and the corresponding suction tube to the side of the capsule. To operate the driving motor and lamp a source of 8 volts d. c. is required. Binding posts for the driving motor and for the lamp are on the outside of the instrument. A suitable switch is conveniently placed so that the pilot may start the record at any desired instant. When the drum is in place and the shutter is opened the instrument is ready to operate by closing the switch.

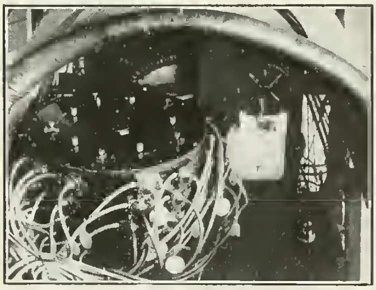


Fig. 3.

The film drum is loaded in a dark room with a fast bromide paper, or its equivalent, with the sensitized part toward the outside. The shutter is closed when the drum is out of the instrument and only opened when ready for the run.

If a longer record is desired, the drum can be made to move at slower speed, by tightening the spring on the governor a slight amount. If a much larger change is desired, stiffer springs may be substituted. The drum speed can also be changed by changing the driving gears.

Pressures on Rudder and Fin

Using the manometer, an investigation has been made by the N.A.C.A. of the pressure distribution over the rudder and fin of a J N 4H in straight flight and in acrobatics (Report No. 149).

The results obtained from this investigation enable designers to know much more closely than hitherto the nature and magnitude of the loads acting on the rudder and fin of an airplane. Contrary to previous beliefs, the loading on the vertical surfaces is generally greater than on the horizontal ones.

It is recommended that in sand-load tests a unit load of 2 pounds per square foot be used, this unit being multiplied by the designed load factor of the wings to give the maximum load on the rudder and fin. The center of gravity of the load may be taken vertically at the same level as the center of gravity of the area, while the fore and aft distribution should be as shown in Figure 10. Care should be taken in all designs to make the leading edge of the fin stiff, as it is believed that nearly all tail surface failures are due to vibration.

Elevator and Stabilizer Pressures

Another series of tests was made, recording pressures on the horizontal tail surfaces (Report No. 148) in spins, dives, etc.

The results of these tests show that tail loads can not be computed from model tests. This is due to the fact that the airplane begins to rotate as soon as the elevator begins to be pulled up, thus relieving the load before it can build up. The tail load necessary to produce an angular acceleration is small compared with that necessary to balance the pitching moment of the wings.

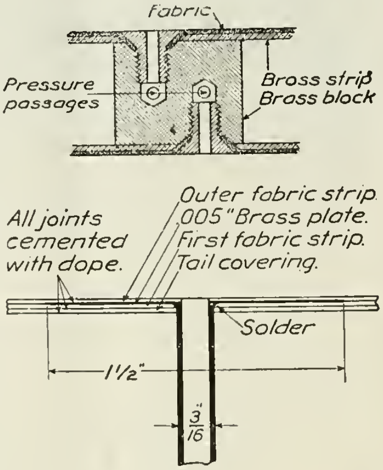


Fig. 4.

The method of calculation based on the wing pitching moments and the angular acceleration gives the tail loads closely in any maneuver where the speed, normal and angular acceleration, and center of gravity position are approximately known.

It seems evident from these tests that the strength of fuselage and tail surfaces on the present machines is excessive, and that a considerable saving in weight can be made.

Pressures on the Wing

Hills and valleys of pressures are shown by the photograph (Fig. 5) of a built-up model illustrating the varying pressures on a square-tip wing. A "map" of the same outer section of a wing shows by contour lines the various pressure differences over the surface (Fig. 6).

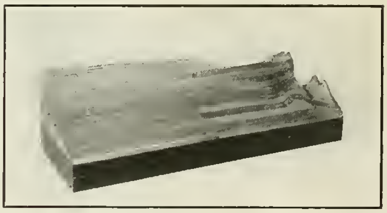


Fig. 5.

Fakir Fuel Pump

IN DESIGNING the Fakir fuel pump, the fundamental idea was to obtain a simple and reliable method of conveying the fuel from a low tank to the carburetor, with the avoidance of the faults of all former methods and the simultaneous warming of the fuel by means of the heat of compression generated.

The principle of the Fakir fuel pump rests on the well-known principle of the diaphragm pump, which must however be suitably adapted to the present purpose. Figs. 1 and 2 are drawings of the pump. Inside the housing (formed by the circular wall A, the front wall A_1, and the rear wall A_2), there is a hollow body Q cast in one piece with walls A and A_1, containing the inter-connected horizontal and a vertical channel Q_1 and Q_2. The channel Q_1 is open toward the diaphragm and contains the spring K which presses against the diaphragm. The channel Q_2 is connected with the inlet D_1 and above into the pump housing. The intake valve F and the pressure valve G are respectively below and above the channel Q_1. The seats of these valves are shaped out of the tube connections F_1 and G_1 which communicate with the channel Q_2. The hollow body Q also contains a second horizontal channel Q_3, which lies below the intake valve F and forms a connection between the vertical channel Q_2 and the space inside the pump housing through the return valve P (for the back flow). The latter is held shut by a spring P_1 which is coiled about a bolt S. The bolt and spring lie in a cross bore F_2 of the tube F_1. The bolt S is screwed into the wall A and its outer end is covered by a screw cap S_1. Below the return valve, there is a non-return or check valve T which, like the inlet valve, is provided with a strainer to keep out any dirt there may be in the fuel. The diaphragm lies between the wall A and the cover J which is clamped on to a special shaped base. This base, which is formed by the wall A_1, is so made that the diaphragm can only yield within suitable limits, without danger or rupture or fatigue, and is then supported by the base so

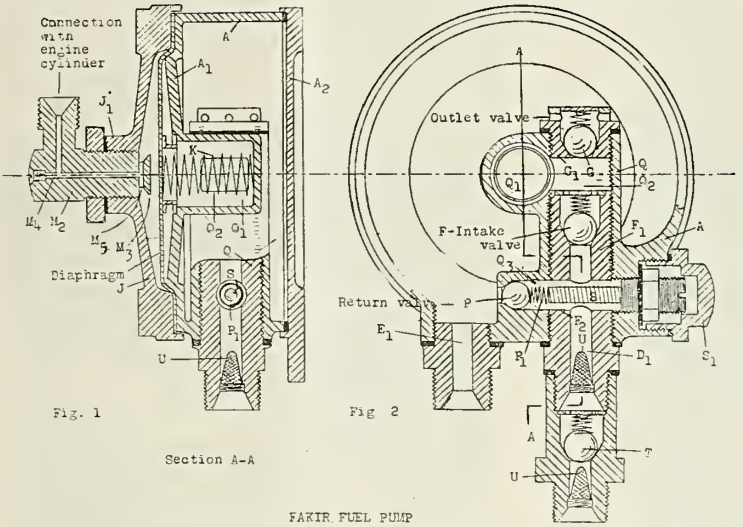


Fig. 1

Section A-A

Fig 2

FAKIR FUEL PUMP

that the high cylinder pressure cannot hurt it. The distance of oscillation in either direction and the pressure of the diaphragm spring have been adjusted by many experiments, so as to come within the elasticity of the metal diaphragm and prevent the possibility of fatigue. For the protection of the diaphragm from the spring, there is a pressure plate on the end of the latter. The gas-pressure space, inclosed between the diaphragm and the cover, is (through the elbow M_2 and the channel M_4, which opens into the gas space through the cross channel M_5) in direct communication with the engine cylinder.

The Fakir fuel pump operates as follows: The pressure variations in the engine cylinder produce oscillations of the diaphragm. During the period of diminished pressure in the engine cylinder, the oscillation of the diaphragm (supported by the force of the spring behind it) draws fuel from the tank, which is then (during the period of compression, explosion and exhaust) driven out again. This process, which is continuously repeated all the time the engine is running, pumps considerably more fuel than the engine requires. The excess fuel must therefore be rendered harmless. This is accomplished by the automatic flow of the excess fuel (which does not run through the outlet E_1 to the carburetor) back through the return valve P into the fuel column under the intake valve F. In order to prevent this action from causing any return flow of the fuel column into the fuel tank, the check valve T is introduced. The pump therefore always delivers to the carburetor only the quantity of fuel required at the time by the engine, while the excess fuel circulates inside the pump. Now, since heat is produced by compression, this circulating fuel is highly heated by coming in contact with the thin metal diaphragm. The fuel is still further heated by the heat conduction of the metal pipe connecting the pump with the engine cylinder, in which pipe hot gases, oil and other fluid residues of the explosions oscillate to and fro. After the engine has been running a short time, these fluid residues fill up the gas space (between the diaphragm and over J) and parts of the delivery pipe, so that, in practice, no increase in the volume of the clearance space takes place in the engine. By suitably adjusting the size and length of the delivery tube from the pump to the engine cylinder, it is possible (within certain limits) to give the fuel any desired amount of preliminary heating and, even for low initial temperatures of the fuel in the tank, obtain final temperatures of 30-35°C in the float chamber of the carburetor. Experience has shown that engines with fuel warmed in this manner can use cold air even in winter and still develop a high degree of efficiency, as well as be able to utilize difficulty volatile fuel.

The Fakir fuel pump can be installed anywhere between the fuel tank and the carburetor, since the flow of fuel to the pump does not depend on gravity, but on adjustable pressure. It may be further said that it is proof against all shocks and changes of inclination on motor vehicles of all kinds (including water and air craft), since it has no movable parts aside from the four valve balls which are held by springs. The chances of its getting out of order are therefore reduced to a minimum. It requires no attention, aside from seeing that the piping is tight, which is an essential condition for any pump.

Paragon Adjustable and Reversible Propeller

THE Paragon adjustable and reversible aircraft propeller, the invention of Spencer Heath, the pioneer propellor maker, made its official debut on October 11 at Bolling Field in a demonstration to representatives of the offices of the Chief of Air Service, Chief of the Bureau of Aeronautics of the Navy, of the Air Mail, the Press and motion picture news associations.

The automobile truck trailer, upon which the propeller and a 150 h. p. Wright-Hispano engine was mounted, was made to maneuver about Bolling Field at the will of the operator.

What new stunts may now be evolved with the aid of a reversing propeller may be left to the imagination. One can easily imagine the two-seater of the future suddenly reversing into a stall and taking a shot from underneath at his surprised adversary overhead. The device is to the aircraft what change speed gears are to the automobile.

It comprises, in short, a system of special blades and a mechanism for varying the pitch of the blades from zero to 360 degrees, while in flight or otherwise.

The invention is being marketed by Paragon Engineers, Inc., 243 E. Hamburg St., Baltimore, Md.

By adjusting the pitch, either before starting or while the engine is running, to a less than normal angle, the engine is allowed to pick up speed and deliver its maximum power which is necessary in taking-off with a heavier load than the same airplane could otherwise normally carry. Upon reaching the desired altitude, the pitch may be increased by the pressure of a finger on a knob on the dash and the engine run at its most economical speed, still with the possibility of increased speed range should occasion demand. As the load is lessened by consumption of gasoline on a long distanced flight, the pitch may be still further increased.

In landing, the pitch of the screw may be changed to any degree in the opposite direction, or "reversed" just before the instant of contact with the ground and the plane brought to a stop in the very shortest space, obviating entirely any prepared ground system of slowing up the machine.

This is a feature of especial moment to naval aeronautics where the shortest run after landing is a prime necessity, owing to the confined space which may be available on a ship's deck or even on that of an airplane carrier ship, like the "Langley."

For the airship, the same advantages of economy are apparent while the reversible attribute exactly doubles maneuverability in docking, whether shed or mooring mast is employed.

It is even possible that the adjustable and reversible propeller may cause rapid advancement in the helicopter, or direct-lift, machine.

It was long realized that the variable pitch and reversible propeller was a development which would travel side by side with supercharged and multi-engined aircraft.

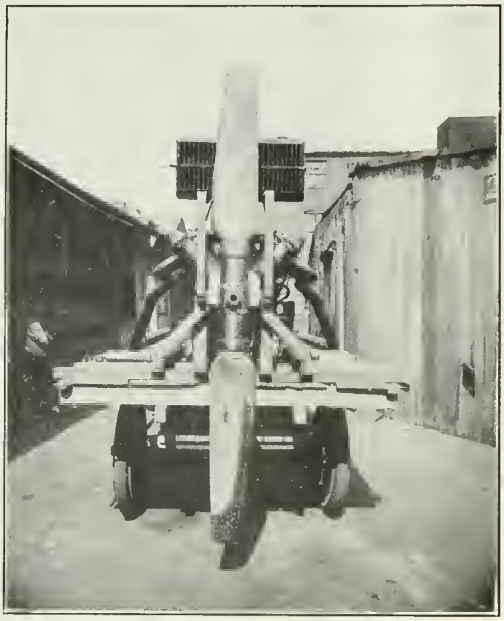
This new design now avoids the objectionable features ordinarily considered with respect to possibilities in this direction.

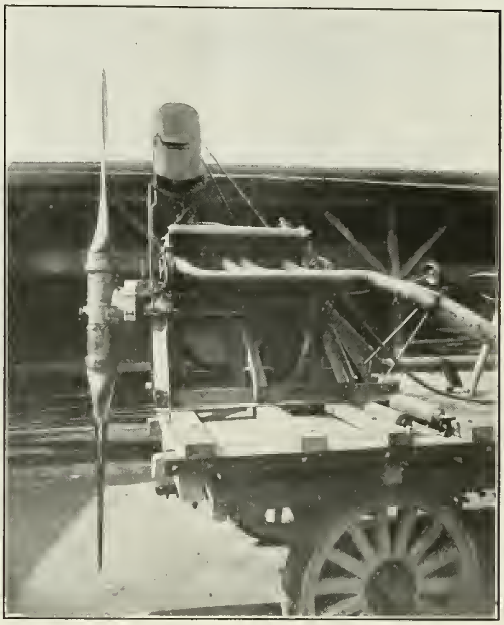
In the Heath propeller there has been achieved:

(a.) Elimination of continuously running gears, collars or bearings in the pitch control mechanism.

(b.) The use in flight of engine power in place of manual labor in changing the blade angle.

(c.) The absence of any structural limitation to the range of blade angles available as well as the limiting of the blade travel between any two predetermined extreme positions.





(d.) Continuous indication on the instrument board of the blade position.

(e.) Automatic throttling of the engine while the propeller is passing through the position of neutral pitch.

General Description of Propeller

The two wooden or steel blades are fastened into steel sleeves which in turn are held in a steel hub, the centrifugal forces being taken on ball thrusts and torsional and axial forces on plain bearings.

The method of fixing the wooden blades into the steel sleeves is noteworthy. The butt end of each blade is tapered outwardly at a small angle as shown in Fig. 1, and the surrounding collar is split so that it may be first sprung over the butt and then compressed upon the taper.

Pitch Changing Mechanism

The pitch changing mechanism is operated through the application of a braking force to either one of a pair of small brake drums surrounding the engine crankshaft and normally rotating with it. The elementary principle is shown by diagram in Fig. 2, which represents a brake drum connected through a gear train to the individual blades of the propeller.

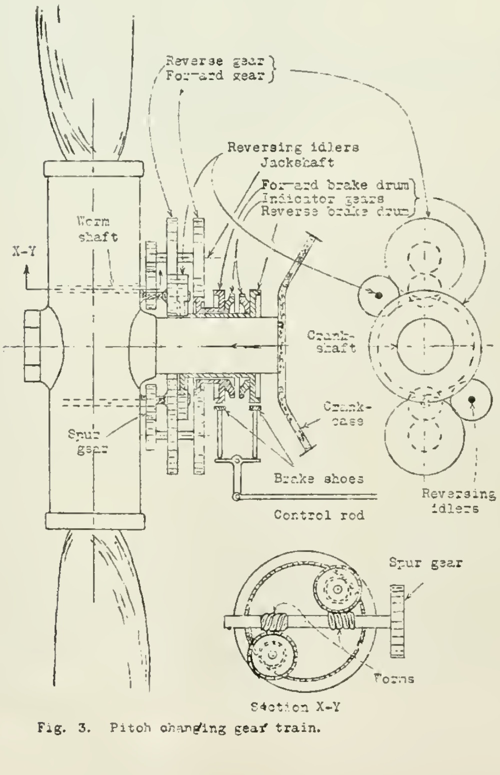


Fig. 3. Pitch changing gear train.

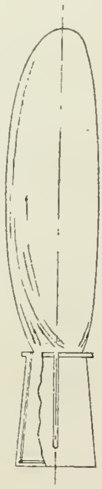


Fig. 1. Split steel sleeve compressed about butt end of propeller blade.

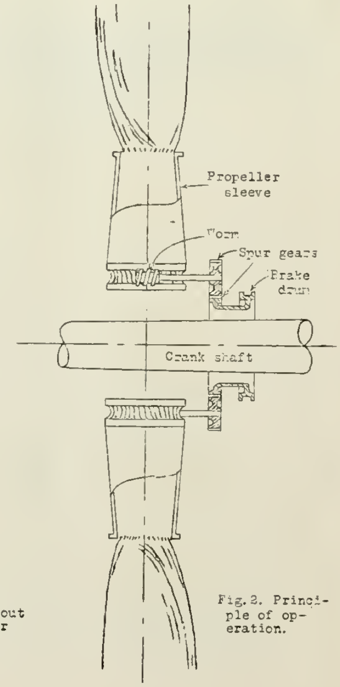


Fig. 2. Principle of operation.

to revolve at crankshaft speed, all the gears will be stationary relative to the propeller and that the pitch angle will remain constant. If, on the contrary, the brake drum is held stationary the gear train will be set into action and the pitch angle of the blade will undergo a continuous change until the brake drum is released.

In order to change the blade angle in the reverse direction a second brake drum is used, connecting to the worm shaft through an idler which serves to reverse the direction of rotation of the worm shaft. It should be noted that during normal flying none of these gears are operative and that the blades are locked in position by the non-reversible features of the worm and the friction of the connected parts.

The actual construction of the pitch changing mechanism is more fully indicated in Fig. 3. The brakes are applied through leather faced shoes operated from the pilot's seat by a light push and pull knob attaching to a brake lever mounted on the drum housing. A small hand crank is provided by which the pitch can be changed while the engine is not running.

Blade Position Indicator

The angular setting of the propeller blades at any instant is a function of the relative motion which has taken place between the two brake drums. The indicating mechanism is therefore operated by gearing from the two brake drums which conveys differential motion to the indicating pointer and the throttling and pitch limiting cams. As long as the two brake drums revolve both at crankshaft speed the indicating hand remains stationary but if either of them is retarded an angular motion is shown on the indicator equal to that experienced by the blades themselves.

Automatic Throttle Control

The mechanical throttle is provided with springs in both directions so that the pilot can at any time by applying a force on the throttle greater than the initial tension in the springs substitute manual for automatic control.

Pitch Limiting Mechanism

In the pitch limiting mechanism the control knob normally connects to the brake levers direct, a push increasing and a pull decreasing the pitch. If the control button is held in either operating position until the limiting position of the propeller blade is reached the cam trips a latch plate and renders the control inoperative in that direction while leaving it ready for use in reversing the direction of propeller blade motion.

Demonstration Under Power

To show the action under power the propeller has been installed on a 150 HP. Hispano-Suiza engine mounted with gasoline tank, observers' seats, etc., on a trailer truck weighing about two tons which is free to roll on the ground. In the demonstrations thus far made the device is put through its entire range of performance, which includes disconnecting the pitch limiting mechanism so that the blade angles are controlled throughout a complete revolution of 360 degrees, both forward and reverse.

With the engine turning at 1500 r. p. m., the angular change from full speed ahead to full speed astern is accomplished in about 3-1/3 seconds.

Navy's Aerial Lighthouse

AN ACETYLENE gas aerial light house has recently been installed by the Navy at the air station at Hampton Roads, Va., and another has been ordered by the Army Air Service for observation at McCook Field. It is not improbable that a line of these may be established on the "model airway" between Washington and Dayton, at the terminals and on the highest ridges in Cumberland, Md., Pt. Marion, Pa., Moundsville, W. Va., Zalesville and Columbus, the vicinity of Charlestown, W. V., Ohio.

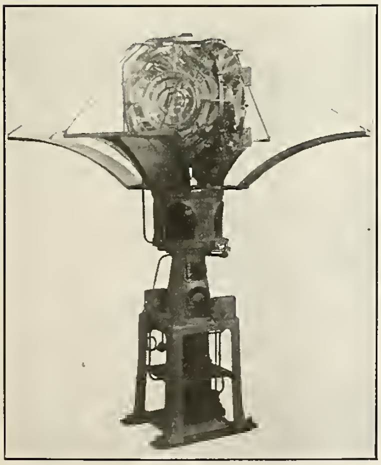
The Post Office is also interested in a system of lighthouses for the step between Chicago and Cheyenne and another prospect is with the Forest Service.

The Aeronautical light of the American Gasaccumulator Co., as bought by the Navy and Army is a mantle light with flasher of the type similar to the same make already in service at the Croydon aerodrome in England, where the light has, in that latitude, an average visibility of 32 miles horizontally and from 2 to 4 miles vertically, but more powerful.

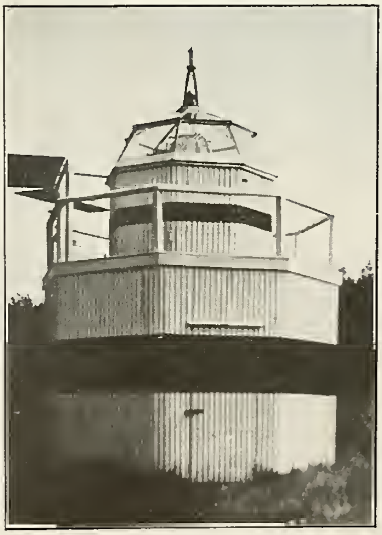
These lights are entirely automatic in operation. They may be placed in almost any inaccessible position which may be the most suitable from a navigational point of view and then left unattended for periods up to 12 months, if desired. The flashing apparatus can be adjusted to give any desired grouping of flashes. When desired, the lights may be fitted with a "Sun valve," which lights and extinguishes the beacon automatically at darkness and dawn from a pilot light which keeps burning.

The optical elements are divided into two sections. The top section consists of half a dioptic drum lens and serves the purpose of projecting a very powerful light slightly above the horizontal plane. The lower elements are catadioptic rings, so arranged as to distribute the light falling upon them at suitable angles above the horizontal plane.

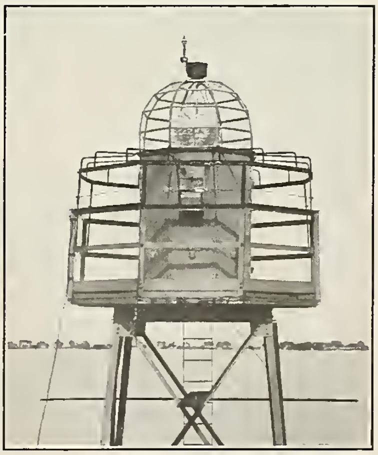
An aviator approaching the light at an altitude not exceeding 8000 feet remains within the area covered by the main beam until he is within about 8 miles of the light. At that range the light source



A. G. A. Light used at Croydon, England.



The A. G. A. Lighthouse at Croydon.

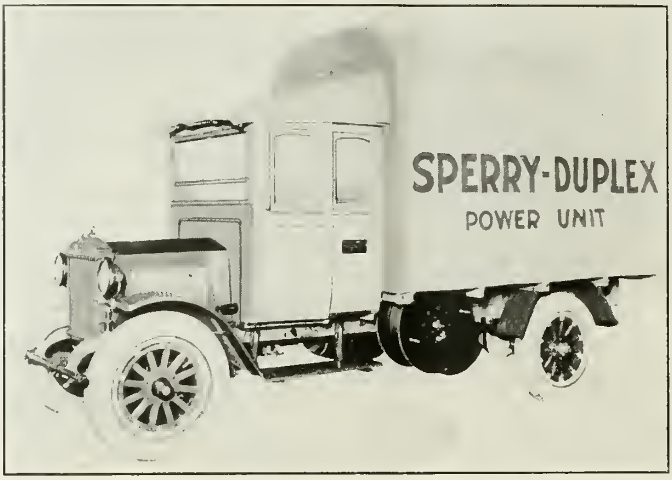


The Aerial Lighthouse at Hampton Roads, Virginia.

itself is easily discernible. The flashing can be adjusted to give any variation of light and dark periods.

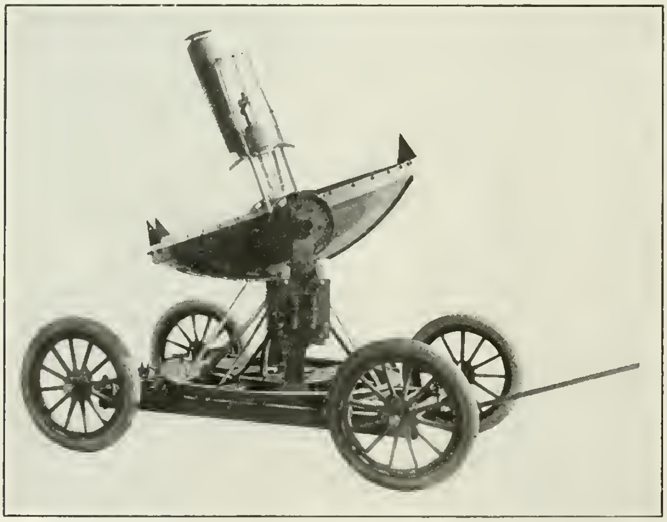
It is argued that existing marine lighthouses and beacons are so designed that the arrangements of optics in them is such as to give a light of maximum power in certain closely defined directions, only, and the vertical angle of dispersion of the light is generally such that it will only be visible to an aircraft pilot through a very small area and at a long distance from the light.

For night flying it is desirable to have a light clearly visible within its range from any point in the upper atmosphere and, in addition, it must have a perfectly clear and precise light character. It is urged that a light signal must be completely repeated not less than from 6 to 10 times while a pilot is approaching it from a distance of 15 miles. At 90 m.p.h., this distance would be covered in 10 minutes and, therefore, a signal having a total period of 35 seconds will be repeated 17 times. In smaller sizes these lights can be furnished in portable form.



The Sperry Portable Power Unit

A beacon of the searchlight type, and portable, has been developed by the Sperry Gyroscope Co. The searchlights which may be of 36" or 44" drum type, high intensity, or 60" open type, are mounted on mobile carriages. An automobile truck contains the power unit for operation in the field.



The Sperry Portable Searchlight

In a recent series of tests, one run was made from Brooklyn, N. Y., to the Army's experiment station at McCook Field, Dayton, O., 697 miles.

On the night trip of the Army nonrigid C2 from Washington to New York and return to Aberdeen, in August last, the Army airship pilots were given their first experience with the night operation of airships with the aid of high power ground lighting. A Sperry searchlight was stationed in New York harbor and during the period of the flight swept the sky in a circle at an angle of about 15 degrees from the horizon. The heavy fog which obscured all the lights of the city from the circling airship 500 feet above Miss Liberty was penetrated by the searchlight's beams which were seen after leaving New York on the return trip until the ship had passed out of Upper New York Bay. It is believed that such a beam can be seen 20 miles in all weather and 75 or 100 miles without a fog, from as low an altitude as 1,000 feet. The rays of such a light are blinding when near, but the aircraft pilot is easily able to see buildings or other landmarks when flashed upon, from considerable distances.

The Prediction of Propeller Characteristics from the Blade Element Analysis

By William H. Miller, M. Sa., Curtiss Aeroplane & Motion Corporation

Continued from October issue

IT SHOULD be borne in mind that the formulas established for the approximate determination of the slip angle of the propulsive airscrew should not be applied to standing thrust conditions. For the static case, θ is in general of such magnitude that the equation

$$\tfrac{1}{2}\, m\, C_L = \frac{\sin \theta \tan \theta}{1 - \tan \theta \tan \gamma}$$

must be solved. This is usually impossible unless $\tan \gamma$ and C_L are expressed as functions of the angle of attack. (For example, C_L and C_D may be expressed, approximately, by linear and quadratic functions of the angle of attack.) Even

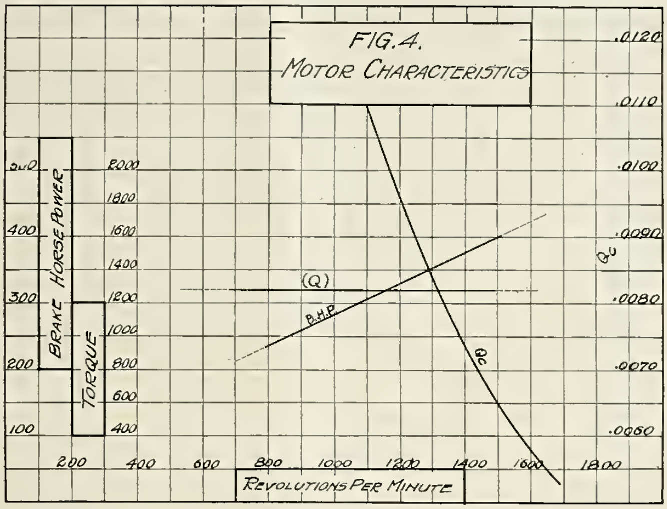


FIG. 4. MOTOR CHARACTERISTICS

then the solution must be performed graphically. It has been the experience of the writer in designing wind tunnel propellers, that the approximation

$$\tfrac{1}{2}\, m\, C_L = \sin \theta \tan \theta$$

can be used. The general method of designing a wind tunnel fan will be made the subject of a later article.

Before beginning the solution of a problem illustrating the use of the formulas obtained thus far, we will state, briefly, the usual method of combining the engine and propeller characteristics. If we have given the engine characteristics, torque and brake horsepower versus revolutions, and the propeller curves, thrust and torque coefficients versus J, the procedure is as follows: Reduce the engine and propeller data to the same units. Then replot the engine torque curve as

$$\frac{Q_m}{\rho\, n^2 D^5} \quad \text{versus } n$$

for the particular value of ρ considered. Since the motor and propeller torques are equal

$$\frac{Q_m}{\rho\, n^2 D^5} = \frac{Q}{\rho\, n^2 D^5} = Q_c$$

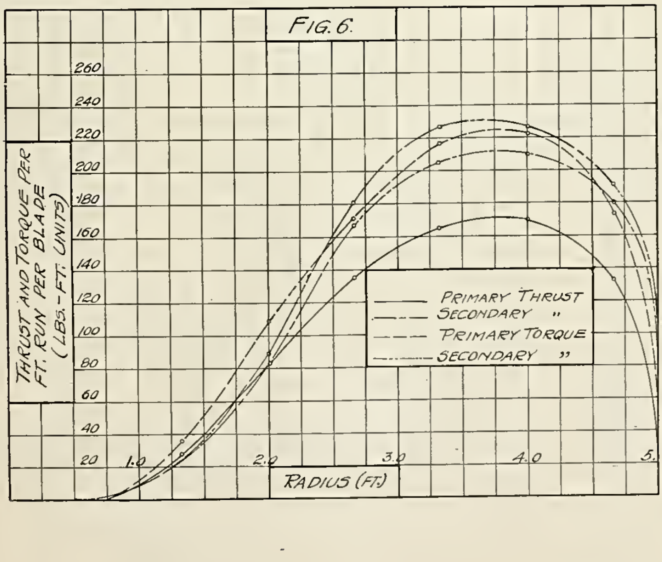


FIG. 6.

Thus one can find the corresponding values of n and J from the propeller torque coefficient curve and the re-plotted motor torque curve. Multiplying the value of J thus obtained by the corresponding value of (nD) we obtain V. Again having given the efficiency, η, of the propeller as a function of J, we know the corresponding values of **n** and **J**, and **Pm** from the motor and propeller curves. Then multiplying this value of Pm by η, we obtain the useful power Pu. The following performance curves of the engine propeller group may then be plotted:

1. Brake H.P. vs. velocity of advance.
2. Useful " " " "
3. Revolutions " " " "
4. Prop. Efficiency " " "

One important point in conjunction with design must be noted: It is necessary to estimate, on first trial, the maximum blade width as accurately as possible in order that, for a given planform, the computed brake power will come out within a few percent of the desired power to be absorbed. This is due to the fact that the required blade angle (being a function of the slip angle θ) is a function of the blade width, since the formulas for θ contain the breadth ratio, $m = \dfrac{Nc}{2\pi r}$.

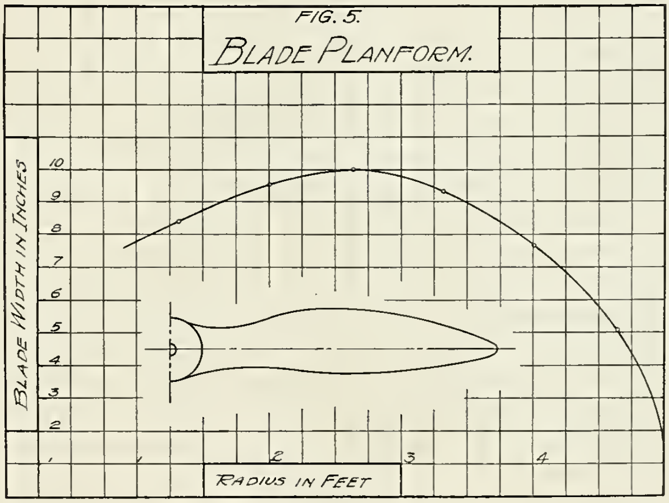


FIG. 5. BLADE PLANFORM.

Numerical Example.

Primary Data:—
Brake horsepower: 400
Standard Density (.07608 lbs./cu. ft.)
Velocity 120 m.p.h.
Revolutions per minute: 1700
Diameter: 10 ft.
Angle of attack 1°.

The motor characteristics over the working range are given in Fig. 4. On the same sheet is plotted the curve

$$\frac{Q_m}{.07608 \times n^2 \times D^5} \quad \text{versus } n$$

The blade planform is shown in Fig. 5, and the section thickness ratios and aerodynamic characteristics, together with the detailed evaluation of the thrust and torque differentials for primary conditions are given in Table III, and Fig. 6. Integration of the thrust and torque curves for primary conditions gave

B.H.P. = 401 $Qc1 = .00650$
U.H.P. = 300
Eff. = 75% (approx.) $Tc1 = .049$

The detailed evaluation of thrust and torque for secondary conditions is given in Table IV and Fig. 6. Secondary conditions gave the following values; for V = 100 ft./sec., and n = 25 rev./sec.,

B.H.P. = 350 $Qc_2 = .00827$
U.H.P. = 202
Eff. = 58% $Tc_2 = .075$

Formulas (8) then gave for the constants a, b, c, and d in the equations of the characteristics of the propeller:

a = .09360 b = .1160
c = .00892 d = .0101

The propeller thrust and torque coefficients may therefore be expressed by the following equations:

$$Tc = .0936 - .116\ J^2$$
$$Qc = .00892 - .0101\ J^3$$

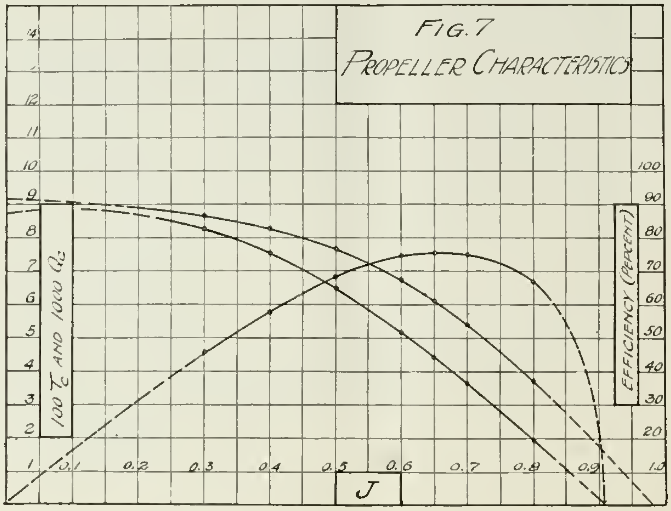


FIG. 7
PROPELLER CHARACTERISTICS

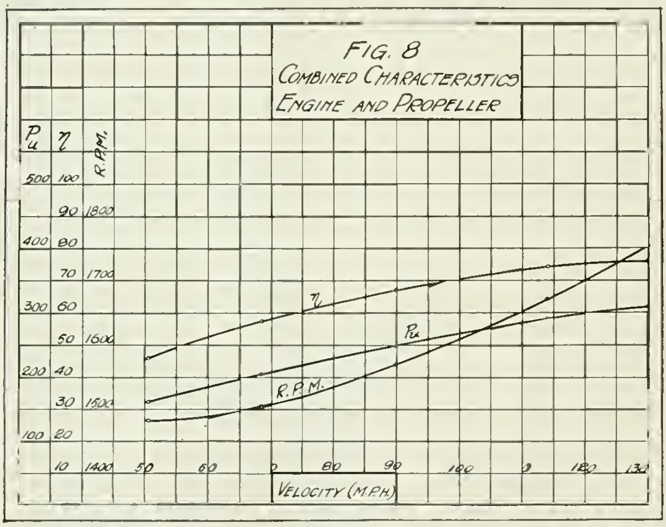


FIG. 8
COMBINED CHARACTERISTICS
ENGINE AND PROPELLER

TABLE III

Evaluation of Thrust and Torque for Primary Conditions :

Station	1	2	3	4	5	6
Radius	1.33′	2.00′	2.67′	3.33′	4.00′	4.67′
2 —r n	236	356	475	591	711	830
tan Ø	.746	.495	.371	.298	.247	.212
cos Ø	.8016	.8962	.9376	.9583	.9709	.9767
Ø	36° 42′	26° 20′	20° 21′	16° 36′	13° 52′	11° 58′
c	.700	.792	.835	.775	.635	.421
m	.167	.126	.099	.074	.050	.029
CL	.275	.340	.300	.255	.220	.193
L/D	10.50	15.00	17.00	18.20	19.23	20.20
—	5° 26′	3° 49′	3° 22′	3° 9′	2° 59′	2° 50′
O	2° 7′	2° 34′	2° 14′	1° 45′	1° 13′	0° 44′
Z′	38° 50′	28° 54′	22° 35′	18° 21′	15° 5′	12° 42′
tan Ø′	.8050	.5520	.4159	.3317	.2695	.2254
sin Ø′	.6271	.4833	.3840	.3148	20.02	21.98
Ø′ + *J*	44° 15′	32° 43,	25° 57′	21° 30′	18° 4′	15° 33′
tan (Ø′ + *J*)	.9747	.6424	.4867	.3939	.3262	.2783
cos (Ø′ + *J*)	.7161	.8414	.8992	.9304	.9507	.9634
V (1 + ½a)	184	191	194	194	191	186
aV	16	30	36	36	30	20
2 — rn b	15.5	19.3	17.5	14.2	9.8	5.5
D	39.8°	29.9°	23.6°	19.4°	16.1°	13.7°
dT/dr	28.0	84.5	136.0	165.0	170.0	133.0
dQ/dR	36.2	109.0	172.0	216.0	222.0	173.0

The propeller efficiency was found by means of formula (9) and plotted with Tc and Qc against J in Fig. 7. The steps in the evaluation of the useful power are given in Fig. 8, where it is seen that the maximum efficiency, 76%, occurs at about 130 m.p.h., outside the working range. The latter point is interesting to note. The advance per revolution prescribed by the primary conditions may not in general give the highest efficiency it is possible to attain with the propeller. However, once the characteristics of a family of similar propellers have been found, one can apply similitude laws to determine the optimum diameter for given conditions.

Conclusions.

While it appears that the working characteristics of a propeller can be predicted to a fair degree of accuracy by means of the conventional blade element method, as developed fundamentally by Drzewiecki, Riach, Bothezat, and others, the theory will never be exact so long as uncorrected aerofoil characteristics, as determined in the wind tunnel, are applied in practise. The vortex theory offers at present the greatest possibilities as regards the development of a really accurate method.

The present article was prepared primarily for the interest of those who desire a simple method of approximating the characteristics of an airscrew over the working range.

(See page 598 for table IV and table V).

Standardization and Aerodynamics

By William Knight, M. E.

ON JUNE 20th, 1921, I published an article in the AERIAL AGE under the title "Standardization and Aerodynamics" in which the suggestion was made of the desirability of calling a Congress of representatives of leading aerodynamic laboratories, without any discrimination between former allies and former enemies, for the purpose of arriving at an understanding as to the coördination of laboratory work in aerodynamics leading to a better utilization of Scientific research knowledge in aeronautics in the interest of all concerned in this matter.

In that article I presented a number of suggestions contained in a report of mine to the National Advisory Committee for Aeronautics which I had submitted to that organization in 1919 while I was representing that Committee in Europe.

The suggestions contained in that report can be summarized as follows:—

The appointed task of the proposed Congress of representatives of aeronautical laboratories and other aeronautical technical and Scientific organizations should be:—

1st—To agree on a number of tests to be made in existing wind tunnels both in this country and in Europe on some standard model, or models, with a view of determining the influence of local conditions prevailing in each wind tunnel (method of attachment of the model to the forces measuring device, dimensions of model as compared to the dimensions of the wind channel, state of turbulence of the air flow, etc.) and the necessary corrections to introduce into the calculations of the results obtained in each wind tunnel on the same model in order to bring such results in line with those obtained in other wind tunnels.

At present such a divergency exists between experimental results obtained in various wind tunnels, when no such divergency should exist, that the confidence of aircraft manufacturers and designers in the usefulness of wind tunnel research work is badly shaken. Such a dangerous situation could be corrected with the organized coöperation of scientists and technical men engaged in research work in aeronautics who know better than anybody else where the trouble is to be found and who, furthermore, are eager to coöperate with each other, if the initiative is taken by some responsible party in calling a truly international congress of representatives of aeronautical Scientific organizations for the purpose of investigating the causes of the trouble and finding the remedy.

2nd—The proposed Congress of Aeronautical experts should take up the matter of definitions, symbols and graphical methods used in aeronautical reports, books and other publications which, at the present time, in the absence of any uniform standard accepted and adopted by leading scientists and aeronautical organizations, same as are adopted in statics, dynamics and in the art of applied engineering, (as for instance in the testing of materials) follow the line of thought of some particular group of technical men without any reference to the symbols, the terminology and the graphical methods of representation used by other groups of technical men in other countries. Here again we are confronted with the fact that scientific and technical aeronautical reports and publications have no other excuse for being edited than their usefulness in facilitating the task of aircraft designers and manufacturers in designing and manufacturing better aircraft.

It is already bad enough that the people of the world do not talk the same language, if we add to this the self imposed handicap of a different scientific language spoken in each country in aeronautical publications, I do not see how we are going to be fully benefitted by the efforts made by scientists and technical men all over the world who are trying to perfect for us a new means of transportation which will have a tremendous influence on the progress of this civilization of ours.

We cannot too strongly insist on the fact that when in reading a report we are stopped either by the meaning of a symbol or by the value of a coefficient it is impossible to follow the sequence of ideas and the report is usually thrown aside.

The proposed Congress can remedy to such a state of things if the matter is approached in a true spirit of international coöperation in the scientific and technical progress of aeronautics, by adopting some fundamental standards which, without any doubt, would be accepted by technical writers all over the world.

How the Discussion on Standardization Started

The suggestion contained in my article of June 20th, 1919 in the AERIAL AGE, gave rise to a very interesting discussion in that review which was contributed by leadng aeronautical authorities and, furthermore, it found an echo in the First International Congress of Aerial Navigation and in an informal congress of leading Scientists and technical men which was recently held at Innsbruck (Tyrol).

Considering the great importance of the subject and the urgent need of arriving at a practical conclusion of the very regrettable state of affairs prevailing at present in the technical and Scientific field of aeronautical work, due to the delay in calling the proposed congress of representatives of leading aeronautical laboratories, scientists and technical men engaged in aeronautical research work in every country, a little history of the case and a resume of the opinions expressed by leading aeronautical authorities on this matter shall be probably helpful.

On May 1919 I was appointed Technical Assistant in Europe to the National Advisory Committee for Aeronautics for the purpose of establishing the promotion of a prompt and cordial exchange of scientific and technical data and information on research and experimental work in aeronautics and sciences thereto allied between the United States on the one hand and the Governments, private institutions and individuals in Europe on the other hand.

In October 1919, in a report to the National Advisory Committee for Aeronautics prepared by W. Margoulis, former director of the Eiffel Aeronautical Laboratory, and at that time my assistant in Paris and Aerodynamical expert of the Paris office of the Committee, the need for the inauguration of a cordial spirit of coöperation between the various leading scientists and organzations doing research work in aeronautics both in Europe and in the United States was pointed out, and the suggestion was made that the Committee should take the initiative in organizing a congress of representatives of aeronautical laboratories to be held in Paris for the purpose of arriving at a mutually satisfactory agreement on the means to be devised for obtaining:—

1st—More reliable results in wind tunnel experimental work, based on a better knowledge of existing conditions in each wind tunnel,

2nd—the adoption of uniform fundamental symbols and definitions in aeronautical reports and publications,

3rd—the adoption of standard graphical methods of representation of ordinary test results so as to facilitate the comparison of results obtained in various countries,

4th—the adoption of a standard method of classification and indexing of aeronautical publications so as to facilitate research work.

The National Advisory Committee for Aeronautics approved all of the above suggestions with the exception however that, considering the fact that the British Advisory Committee for Aeronautics had contributed during the war a good deal more than the corresponding American Committee to the advancement of aeronautics, it was deemed desirable that the initiative in originating a move such as I had suggested would be taken by the British rather than by ourselves.

Accordingly I took up the matter with the British Advisory Committee for Aeronautics and communicated to them the views of the N.A.C.A. on this matter.

In 1920 an invitation was issued by the British Advisory Committee for Aeronautics to our own Committee and to the leading aeronautical laboratories in France, Holland and Italy to conduct a number of comparative tests in their various wind tunnels on the same model—No invitation was issued to German and Austrian Laboratories to participate in these tests, and no provision was made for agreeing on the unification of symbols, definitions, graphical methods, etc.

In June 1921 I resigned my position as Technical Assistant in Europe to the National Advisory Committee for Aeronautics and I published in the AERIAL AGE under the title "Standardization and Aerodynamics" the suggestions contained in my earlier report to that committee regarding the organization of a Congress of representatives of aeronautical Laboratories both in Europe and in the United States. Since that time the following comments have been expressed in the technical press and elsewhere on this subject:—

German Comments

Prof. L. Prandtl, Director of the Aerodynamical Laboratory of the University of Göttingen, Germany and one of the foremost German scientists who has greatly contributed to the present stage of development of Aerodynamics, approves of the idea of calling the proposed congress, which however, he suggests, should be preceded by an exchange of views by correspondence between those participating to the Congress, so as to prepare the ground for a quick settlement of the various points involved. He offers a number of valuable suggestions as to the way comparative tests should be made in the various wind tunnels in order to bring about a better agreement between testing results obtained in various countries.

Dr. Ing. W. Hoff, Director of the Deutsche Versuchsanstalt für Luftfahrt at Adlershof, Germany, in a letter addressed to me endorsed Prof. Prandtl's comments and suggestions.

Prof. Von Karman, Director of the Aerodynamical laboratory of Aachen, Germany, points out the important need of reaching an agreement on the matter of standardization of symbols, coefficients and methods of measurement of air speed in wind tunnels. He points out the many objectionable features of the present state of things which is fraught with danger to the science of Aerodynamics—he thinks that an international aeronautical association organized along the same lines as the International Society for Testing Materials would provide a very good permanent medium of exchange of views between Scientists of all nations in the interest of Standardization—he approves of the idea of calling a congress of representatives of aeronautical laboratories which he suggests should be instrumental in laying the foundation of a permanent International Scientific Aeronautical Association. (Aerial Age, January 2, 1922)

Italian Comments

Col. Ing. G. Costanzi former Director of the Royal Aircraft Establishment in Rome, Italy, who during and after the war was the representative of the Italian Air Service to the Supreme War Council in Versailles, and the technical representative of Italy to the permanent Interallied Aeronautical Commission in Paris approves unreservedly the calling of the Congress and the suggested matter to lay before the Congress for discussion. He emphasizes the necessity of putting a stop to the prevailing lack of agreement between experimental results obtained in various laboratories. He also states that it would be unconceivable to reach any agreement in this matter without inviting the representatives of German Aeronautical Laboratories to the proposed Congress which, in his estimation, should be held in Germany, where aeronautical works of the highest order of both scientific and practical importance have been originated in the last few years. (Aerial Age, February 20, 1922)

Lieut. Col. Ing. R. Verduzio, Director of the Aeronautical Experimental Institute in Rome, Italy, considers the suggestion as a timely one, approves the program laid out for the Congress and states that Italian Aeronautical Services shall be very glad to coöperate to its realization. (Aerial Age, April 3, 1922)

Lieut. Col. A. Guidoni, Aeronautical Attache to the Italian Embassy in Washington and a well known authority in aeronautics, suggests in a letter to the writer that the matter of the adoption of the metric system in aeronautical measurements should be taken up by the Congress in connection with the matter of Standardization of Symbols. He points out that the Interallied Aeronautical Committee had already started a very important work of Standardization which could be taken as a basis for further expansion by the proposed Congress.

French Comments

W. Margoulis, former Director of Eiffel Laboratory, Paris, France discussing the tests suggested by the British Advisory Committee for Aeronautics, points out that comparative tests in wind tunnels, in order to serve the purpose for which he originally suggested them, must be both numerous and systematic in order that, as a whole, they may characterize the airflow in each wind tunnel. The tests suggested by the British Advisory Committee for Aeronautics are to be made on a model of Streamline body supplied by the National Physical Laboratory and successively tested in the various laboratories in England, France, Holland, Italy, and the United States. Mr. Margoulis points out that in October 1920 in a paper read by him at one of the monthly meetings organized in Paris by himself and the writer for the discussion of Aeronautical problems (and which was published in the "Technical Review of Aeronautical Works" issued by the Paris office of the National Advisory Committee for Aeronautics) he suggested that comparative tests in wind tunnels, in order to be effective, must include tests on spheres, cylinders and streamline bodies of different dimensions and aspect ratio, tested at all available speeds in each wind tunnel and also in the open air on the aerodynamical truck of the St. Cyr Institute, so as to supply a much needed knowledge of free flight tests of models as compared to wind tunnel tests of the same models. (Aerial Age, March 6, 1922)

Austrian Comments

Dr. Ing. Richard Katzmayr, and Prof. Ing. Richard Knoller, of the Aerodynamical Laboratory of the Technischen Hochschule of Wien, Austria both agree on the urgent need of calling an International Congress of representatives of Aeronautical Laboratories and suggest preliminary comparative tests in wind tunnels of various countries on standard bodies such as Spheres, Streamline bodies and one or two airfoils, the same models to be successively tested in the various wind tunnels. These preliminary tests to be made for the purpose of determining what the writers call a "laboratory factor" or a constant expressing of all those elements which are peculiar to each wind tunnel and which cannot be deduced mathematically, such as: turbulence of the air stream, ratio between dimensions of model and dimensions of working section of wind tunnel and, especially, the influence of the method of fastening the model to the balance.

Prof. Knoller and Dr. Katzmayr also state that one of the most important tasks of the proposed congress should be the standardization of symbols and definitions used in aerodynamics and make suggestions along this line. Prof. Knoller as early as the year 1914 suggested the adoption of absolute units in fundamental formulas used in aerodynamics—as to the unification of methods of graphical representation it is pointed out that both in Germany and Austria the same methods are used. (Aerial Age, May 8, 1922)

Dutch Comments

Dr. E. B. Wolff, Director, Dr. C. Koning and Dr. A. G. Baumbauer in charge of the aerodynamical tests at the Aerodynamical Institute of Amsterdam (Rijka-Studienst voor Luchtvaart), entirely agree on the necessity of calling the proposed congress and unreservedly approve of the suggested program of activities of such congress. On the matter of comparative wind tunnel tests, they agree on the preliminary limited program suggested by myself but they suggest an additional number of Systematic tests to be undertaken by only a few of the most up-to-date laboratories in order to separate the causes of errors in wind tunnel experimental work as due to: the method of measuring forces, the influence of the boundaries of the air stream and the nature of the air stream itself. This last cause of error, which includes: irregularities of the air velocity at different points of the cross section of the wind tunnel in regard to time, turbulence of every kind and variation of static pressure, however, should be investigated quite thoroughly in every wind tunnel. (Aerial Age, June 1922)

American Comments

Dr. A. F. Zahm of the Aerodynamical Laboratory, Bureau of Construction and Repair, U. S. Navy, believes that the inclusion of a very great number of laboratories in the comparative tests is not advisable at the beginning, but he is certainly in favor of making these tests in the most important aerodynamical laboratories and he points out that in order to bring about the desired results, the experimental program adopted should be at least as comprehensive as the one suggested by Dr. E. B. Wolff in the Aerial Age of June 19, 1922 and should be followed up in accordance with a common plan of attack and with a common formulated theory to furnish guidance and precaution. In two papers published by the National Advisory Committee for Aeronautics (Note No. 23 and Report No. 139) Dr. Zahm had emphasized this feature when the committee was working on its program of comparative wind tunnel tests which we will mention later on. He also believes that the most direct way to study accurately and convincingly the correction to be made for Reynolds numbers in applying model data to aircraft, would be to insert the full scale craft in a wind tunnel of suitable size and he suggests the building of a wind tunnel 10 meters diam. x 20 meters long at the throat providing a wind stream of 10 to 30 meters per second and requiring about 5000 horse-power. In his opinion, such a wind tunnel would be more useful to aeronautics than anything else at the present time. (Aerial Age, September 1922).

In connection with Dr. Zahm's remarks on the usefulness of a large wind tunnel allowing aerodynamical tests on full size aircraft I might mention here that a complete project of a wind tunnel of the same dimensions and requiring the same power as the one mentioned by Dr. Zahm was prepared by Mr. W. Margoulis for the Belgian Government and was transmitted by myself to the National Advisory Committee for Aeronautics in 1920, strongly recommending that it should be taken under consideration. Also, in 1920, a project of a compression wind tunnel (this project also by Mr. Margoulis) was submitted to the Committee by my office in Paris and eventually the tunnel has now been built at Langley Field and shall probably prove to be a very useful testing device, without however detracting any from the very practical (although rather costly) usefulness of a large wind tunnel allowing making tests on full scale aircraft.

The National Advisory Committee for Aeronautics, replying to a letter of mine of last May requesting a statement of the present views of the Committee on the matter of the Congress of representatives of Aeronautical Laboratories which I suggested to them in 1919, makes the following statements:—

(1) "The standard tests mentioned by the British Aeronautical Research Committee are entirely separate from the tests that we have outlined for the wind tunnels of this country. There is however, a connection between the work of our Committee and the Canadian Air Board and it is contemplated that the models for test in wind tunnels prepared by the Aeronautical Research Committee will be forwarded to our committee

by the Canadian Air Board, after they have been tested in the wind tunnels in Canada. By the same arrangement we will forward the models prepared by this Committee to the Canadian Air Board, and it is contemplated that when the tests of models are made in all the wind tunnels in this country, the models will be sent to Europe after tests have been conducted in Canada.

(2) The aerodynamic Laboratories of Germany and Austria were not excluded from the general list where it is proposed to have the models tested outside of the United States.

(3) The Committee is very sympathetic in regard to reaching an understanding with all countries for the standardization of symbols and methods of graphical representation used in aerodynamics.

(4) The Committee is not willing to take the initiative in the forming of an International Congress for the Standardization of aerodynamics. *Such a congress must of necessity be international in scope and it would be impossible for the Committee to have an official representative there, as the United States Congress does not look with favor upon the United States being officially represented at any international conference.* We would, however have a representative present who will probably join in the discussion but would not have the official standing necessary to vote."

British Comments

The British Aeronautical Research Committee answering a letter of mine requesting a statement of their point of view in the matter of the proposed Congress writes to me:—

"Your letter of March 28th was brought to the attention of the Research Committee at their meeting of April 11th, 1922. They were interested to learn of the steps that had been taken to provide a preliminary exchange of views between a number of experts who had communicated articles in the "Aerial Age" but they do not consider that the time is yet come for the proposed congress of representatives of aeronautical research laboratories. Perhaps the best step that could be taken to coordinate the work of these different laboratories has already been projected, since the international trials on certain models have commenced and the models are en route to the various laboratories approached by the British Aeronautical Research Committee. It seems doubtful whether any additional advantage can be obtained in calling together, at a great expense, a congress of the proposed nature, since at present there is only a relatively small quantity of research work on aerodynamics being carried out throughout the world, and the best means of coördinating work already published arises with the collection of results of tests by the various laboratories on the same models and this is in hand.

We are not at present aware of what steps have been taken to coördinate the standardization of aeronautical terms and symbols. Some years ago, the Royal Aeronautical Society prepared a glossary of aeronautical terms, and later the American Authorities prepared a similar glossary. These agree in most respects. Since that date, the French Authorities have translated the English glossary and are, we understand, in touch with the British Engineering Standards Association with reference to the new revision of the old glossary, which is being prepared by this Association in coöperation with the Royal Aeronautical Society, the Air Ministry, The Aeronautical Research Committee and other technical aeronautical bodies in this country."

Comments Made at the First International Congress of Aerial Navigation

At the First International Congress of Aerial Navigation held in Paris in November 1921 the matter of international coöperation in systematizing wind tunnel work leading to the adoption of uniform fundamental symbols and definitions was the object of a lively discussion contributed by representatives of French, Italian, Dutch, Spanish and other European aeronautical laboratories. American and British laboratories were conspicuously absent at this First International Congress of Aerial Navigation and German Laboratories were not allowed to join.

Mr. Herrera, Director of the Aerodynamic Laboratory of Madrid, Spain, at one of the meetings of The Technical Committee of the First International Congress of Aerial Navigation suggested the organization of an "International Union of Aerodynamic Laboratories" headed by one laboratory (he suggested the Eiffel Laboratory) which should formulate a program of comparative tests on a number of models. According to Mr. Herrera, the same set of models should be successively tested in the various laboratories, following the particular method of experimentation of the laboratory making the tests. After the tests have been completed in all laboratories, the results should be compared and, from the results of such a comparison, enough data should be available as to allow of the adoption of uniform coefficient and the standardization of methods of future experimental work in wind tunnels. (Frankly we fail to see that the matter is so simple as Mr. Herrera seems to think). Mr. Herrera also suggested that this work should be planned for by the one laboratory representing the proposed International Union of Aerodynamic Laboratories and be carried through by the various Laboratories under the supervision of this superdirecting laboratory (the Eiffel Laboratory).

Prof. Soreau, Vice President of the Aero Club of France and Chairman of the Technical Committee of the First International Congress of Aerial Navigation, objects to Mr. Herrera's suggestions for two reasons: 1st—because he does not see that it is possible to establish a supergovernment of aerodynamical laboratories as suggested by Mr. Herrera and, 2nd—because in order to compare the results obtained in two laboratories it is essential that the conditions under which experiments are made be the same, therefore, it seemed to him that the proper thing to do would be to adopt first uniform methods of experimentation (as for instance the same method of attaching the model to the balance) and then make the tests, rather than doing the reverse as Mr. Herrera suggested.

Dr. E. B. Wolff, Director of the Aerodynamical Laboratory of Amsterdam, Holland, referring to his correspondence with the National Advisory Committee for Aeronautics and the British Aeronautical Research Committee regarding the proposed comparative wind tunnel tests, states that after receiving the invitation to participate in the tests suggested by the British Aeronautical Research Committee he has not heard any more about this matter. He suggests that something should be done, without any further delay in order to start the proposed comparative tests on the same models in the various tunnels.

Mr. Louis Breguet, French Aircraft Designer and Manufacturer, endorses the suggestion made by Mr. Herrera and by Dr. Wolff and suggests the appointment of a committee charged to make definite suggestions leading to the standardization of methods of experimentation in wind tunnels and to the standardization symbols used in aeronautical works.

Mr. W. Margoulis, reports to the Congress the initiative taken by himself and by myself in 1919 in order to bring about the proposed comparative tests. He deplores that the British Aeronautical Research Committee has not gone any further in the realization of its test program than issuing an invitation to participate in some comparative tests on a model prepared by that committee, which, however, has never been sent to the various laboratories to which the invitation was issued.

Prof. Soreau, chairman, answering Mr. Margoulis's remarks regarding our unsuccessful efforts in 1919 to try to induce the National Advisory Committee for Aeronautics to take the initiative in bringing about a much desirable co-operation between aerodynamical Laboratories, states that he knows the reasons why both Mr. Margoulis and myself failed three years ago. He could not reveal what the reasons were but he could state nevertheless that the stumbling block was represented by some governments (meaning the United States, quite evidently) who are not inclined to take part in international conferences. Such being the case, he said, it would seem that the appointment by the First International Congress of Aerial Navigation of a committee such as it had been suggested by Mr. Breguet would not constitute the most advisable step to take at the present time, especially considering the fact that most of the aerodynamic laboratories in every country are under government control. In his opinion, the best thing to do would be to adopt a number of resolutions and submit them to the French Under-Secretary of State for Aeronautics which would take up the matter of Standardization of Symbols notations and methods of experimentation with foreign governments.

Mr. Breguet and Mr. Prix of the St. Cyr Aerodynamic Institute insist on the appointment of a committee.

Col. Verduzzio, Director of the Aerodynamical Laboratory of Rome, Italy, points out the great disadvantage under which the work in aerodynamics is proceeding at present in the absence of an understanding between aerodynamic laboratories on the matter of experimental methods adopted and in the absence of uniform symbols and notations having the same meaning in every country. The latter, according to Col. Verduzzio is of the greatest importance and he submits to the Congress a list of symbols and notations prepared by the Italian Aeronautical Technical Services which, he suggests, could be taken as a basis in the discussion for the adoption of international standards. Col. Verduzzio refers to the failure of the British Aeronautical Research Committee to carry through the proposed program of international wind tunnel tests on a model supplied by them and, in order to get started, he suggests that each Laboratory should make its own model from the same drawing and start the tests.

Col. Fortant, Director of the French Technical Section of Aviation, suggests that, independently of any governmental action by the Under-Secretary of State for Aeronautics in dealings with foreign governments in the matter under discussion, as suggested by Prof. Soreau, the suggestion made by Mr. Breguet and others regarding the appointment of a committee be at least unofficially adopted and that the representative of aerodynamic laboratories attending the Congress meet together and exchange their views on the matter of symbols and comparative tests which, in their opinion, should be the object of an international agreement.

Resolutions Adopted by the International Congress of Aerial Navigation

At the close of the First International Congress of Aerial Navigation the following resolutions were adopted expressing the views of the Technical Committee which were offered by the Congress with the suggestion that they should be adopted by Governmental and civilian aeronautical organizations:

"Resolution No. 3—To make a study of the measures which may be immediately adopted in the test methods of aerodynamical laboratories in order to make it possible to compare results; in particular to define the geometrical forms and the material realization of a large number of typical models, which tested systematically in well defined conditions, would serve, in some sort, as a characterization of a wind tunnel; also to bring about an agreement that the same collection of such models be tested successively in the various laboratories.

"Resolution No. 4—Unification of terms and notations employed in the aeronautical publications of the different countries."

The appointment of a committee charged with the actual carrying through of the work outlined in resolutions No. 3 and 4 which had been advocated by Mr. Breguet and others did not take place and, besides expressing a more or less sentimental wish that somebody, somewhere, would do something in the direction pointed out in the two resolutions quoted above, the First International Congress of Aerial Navigation did not do a thing for bringing about the much desired international wind tunnel tests and the standardization of symbols, terms and graphical methods employed in aeronautical publications of the different countries represented at the Congress, in spite of the fact that urgency of such a measure had been pleaded for by the representative of every aeronautical laboratory attending the congress.

It is no wonder, however, that the first International Congress of Aerial Navigation could not accomplish anything in a matter such as this which required the cordial co-operation of scientists of every nation, when we stop to consider that American and British scientists were conspicuously absent and German, Austrian and other scientists of former enemy nations were not allowed to join this congress which was held under the auspices of the French Government.

The Moral of a Sad Story

From the above history of the fruitless efforts which have been made during the last three years by scientists and technical men of all countries interested in aeronautics in order to bring about a much needed international co-operation in aeronautical research work in the interest of aeronautics as a science and as a new and tremendously important branch of engineering, we can draw the following conclusions:

(1st) It is well recognized by all leading authorities in aeronautical research work that the lack of co-operation between the various aerodynamic laboratories in adopting a common standard whereby the results of wind tunnel tests can be intelligently interpreted and compared to each other (wherever it stands to reason that such a comparison should be possible) is fraught with danger and tends to destroy the confidence of aircraft designers and manufacturers in wind tunnel tests which are now the only scientific guidance that aerodynamics can give to the aircraft designing engineer in order to allow better and safer design of aircraft.

(2nd) The present chaotic condition existing in the matter of symbols, definitions and methods of graphical representations used in aeronautical technical reports and publications edited in various countries, makes it almost impossible for anybody who is not familiar with the technical aeronautical terminology adopted by each country to derive any benefit from publications and reports edited in any other country than his own.

(3rd) The present lack of co-operation between aerodynamic laboratories and the handicap brought about by the absence of a uniform scientific aeronautical language having the same meaning in every country, is not due to a lack of appreciation by scientists and technical men engaged in aeronautical research work of the very undesirability of the prevailing situation. On the contrary, almost all of them are ready to enter into and to abide by any sort of international agreement which will correct the present state of affairs.

(4th) Due to the fact that all leading aeronautical laboratories and other aeronautical scientific organizations in the world are under government control, any initiative in the desired direction can only be taken at the present time by one, or more, governmental aeronautical institutions with the approval and the active support of the government machinery back of it.

(5th) Any move of this sort originated by the aeronautical services of any of the big nations in Europe is bound to be influenced by political considerations, by limitations imposed by the treaty of Versailles, and by resolutions officially adopted during the war at interallied meetings of prominent scientists and representatives of academic bodies on the matter of post-war co-operation with scientists of, at that time, enemy countries.

(6th) Quite evidently under these conditions it is impossible to reach a truly international agreement, such as it is desired, as long as German aeronautical progress and German scientists are either ignored or snubbed.

The failure of the First International Congress of Aerial Navigation to work out any plan for meeting the situation, which had been brought to their attention by those most interested in and most concerned with the desirability of reaching an agreement on the matter of international co-operation in aeronautical research work and on the matter of standardization of aeronautical technical terminology, provides the best illustration of the futility of placing any hopes in the outcome of the vague recommendations presented by its technical committee to the French Under-Secretary of State for Aeronautics.

(7th) The program of wind tunnel tests on a single model successively tested in various wind tunnels in Europe and in America which was outlined by the British Aeronautical Research Council almost three years ago (and which, as far as I know, has not materialized as yet) did not include and does not include at the present time, for all I know of, the co-operation of German Aeronautical laboratories. Furthermore that program was not prepared with the collaboration of any of the laboratories invited to join in the proposed tests; it was simply a British ready-made program of wind tunnel investigation work which discussion in the Aerial Age of this subject has failed to prove that it was the most acceptable one to all concerned. On the contrary that discussion has lead to the contribution of a good many suggestions by prominent aeronautical authorities which most certainly should be taken into consideration before formulating a program of international coöperation in a work which is to be purposely undertaken in the interest of the scientific and technical progress of aeronautics in all countries.

Our National Advisory Committee for Aeronautics an Important Factor in International Aeronautics

When three years ago I suggested to and strongly urged upon our National Advisory Committee for Aeronautics to take the initiative in calling a meeting in Paris of the representatives of leading aeronautical laboratories in the United States and in Europe for the purpose of outlining a program of international wind tunnel tests which would have eliminated the present objections to wind tunnel experimental work, and which would have laid out the basis for the adoption of a much needed consistent uniformity in aeronautical technical terminology, I was prompted by the fact that I knew that our National Advisory Committee for Aeronautics was the only aeronautic scientific organization in the world which could have undertaken this task and carried it through to a successful conclusion.

In fact, this Committee had the assurance of the most effective co-operation of scientists of all nations (former allied and former enemy nations) who, in spite of the official taboo which separated and still separates in most European countries scientists in two groups: *friendly* and *enemy*, would have welcomed any attempt on our part to bridge the gap, insofar at least as aeronautics are concerned.

Furthermore, our National Advisory Committee for Aeronautics being as it is directly responsible to the President of the United States and to Congress only, is the only aeronautical scientific organization in the world under Government control which is independent of all governmental departments, while at the same time it co-operates with all of them as well as with our national aircraft manufacturing industry, with engineering societies, universities and other educational and academic bodies engaged in aeronautical research work in this country.

The contribution made by this Committee to the advance of research work in aeronautics during the last five years, with the insufficient funds placed at its disposal by Congress, places our National Advisory Committee for Aeronautics in a position of natural leadership in the scientific field of aeronautics, and furthermore, the disinclination on the part of the American people to discriminate between scientists of former enemy and former friendly and neutral nations would have created an atmosphere of confidence and a spirit of effective co-operation in a meeting of representatives of aeronautical research laboratories organized by this Committee. This, however, could not be accomplished due to the fact that the National Advisory Committee for Aeronautics must look upon Congress for guidance on all matter more or less directly related to our dealings with foreign nations. As it is stated before, the Committee (1) is very sympathetic in regard to reaching an understanding with all countries for the Standardization of symbols and methods of graphical representation used in aerodynamics (2) it is more than sympathetic in regard to wind tunnel tests leading to a definite and practical utilization in the future of wind tunnel work and (3) it is not disposed to ignore the existence of German and Austrian Aeronautic laboratories and scientists. On the contrary this Committee has been the first one which has adopted for wings the same co-efficients used by the Göttingen Laboratory simply because they were the most logical coefficients to adopt. (This example, I understand, is going to be followed by French laboratories. As far as British laboratories are concerned, it is very doubtful indeed if they will ever adopt symbols coefficients and graphical methods of representation others than their own).

The Views of Congress on International Coöperation

The stumbling block on the road of progress and international coöperation at least in the scientific field of aeronautics) which could have been brought about by the only governmental aeronautical research organization in the world capable of obtaining the desired results, is represented by the unfavorable standpoint from which our present Congress is inclined to look upon any international conferences between ourselves and European powers. Under the circumstances, it is quite natural that the National Advisory Committee for Aeronautics should not be willing to take the initiative in the organization of an International Congress for the Standardization of Aerodynamics. As a matter of fact, should such a congress be organized by another nation, our National Advisory Committee for Aeronautics could not even be officially represented there, same as it has not been represented at the First International Congress of Aerial Navigation or at any other of the international aeronautical conventions which have taken place in Europe during the last three years, where most important decisions affecting international aerial navigation have been taken in our absence, without any reference whatsoever to our present or future interests in that direction.

It is not this the proper place for discussing either the wisdom of the narrow mindedness of our policy of isolation (neither splendid nor always consistent with our national interests) which we are pursuing under the present Congress in every event taking place, sometimes three and sometimes twelve miles off our shores, but this is certainly the place where we can say that the unwillingness of Congress either expressed to, or assumed by, the National Advisory Committee for Aeronautics, to allow that body, who has done and is doing some splendid work, to establish closer ties between American and European aeronautical scientific research institutions, is neither consistent with the progress of aeronautics nor with dignity of an organization which should be left free to work in the interest of science unhampered by political considerations.

When three and a half years ago I suggested the establishment of an office in Europe of the National Advisory Committee for Aeronautics for the purpose of establishing and maintaining a cordial exchange of thoughts between American and European Scientists working on Aeronautics and Sciences thereto allied, and when my suggestions were approved by that Committee and I was appointed its representative in Europe for the purpose of carrying through that program, the keynote of our National policy was: co-operation with Europe. We went too far, however, or probably our motives and our lofty ideals which prompted our desire to co-operate with Europe in the re-establishment of order and peace in the world were not met with in the same spirit such as we were actuated by. At any rate, with the advent of the new administration, a complete reversal of our foreign policy took place and, helas, I soon discovered that the fine spirit of international scientific co-operation in Aeronautics, which had provided the only reason for establishing a foreign office in Europe of the National Advisory Committee for Aeronautics, had been damped to such an extent that my activities in promoting co-operation were actually embarrassing the Committee. After two years of persistent efforts I had to withdraw from a work which, however, I feel has sown good seed which shall bear fruits later on when it will be more fully realized, both in this country and in Europe, that the root of all our evils in the difficult period of evolution of the human race that we are going through is the lack of co-operation between the intellectuals of all nations.

The Discussion Has Served its Purpose

The efforts made by Mr. Margoulis and myself during the last three years for promoting a congress of representatives of aeronautical research laboratories and other scientists working in aeronautics in the interest of the scientific progress of Aeronautics have not been lost, and the discussion in the Aerial Age of the subject "Standardization and Aerodynamics," I feel, has served its purpose which was to show that intellectual co-operation in aeronautics can be achieved and must be achieved by taking into consideration the views of all before trying to place our own interpretation on what should be done in the pursuance of a plan calling for the co-operation of others.

The suggestions that we made three years ago on the subject of wind tunnel tests have been adopted in principle by all aerodynamic laboratories, however, both the British Aeronautical Research Council and our National Advisory Committee for Aeronautics have each formulated a test program of their own without taking under consideration the views of other laboratories and each proposes to go ahead with its own program and make its own models, test them according to its own ideas and then ask other laboratories to duplicate the same tests on the same models.

Other laboratories, I understand, are planning to do the same thing and the consequence of this lack of co-operation between the various laboratories in formulating a unique program of experimentation agreeable to all shall bring about a useless loss of time and energies. Since the necessity of making these comparative tests has been recognized by all concerned why not try to make them as complete as possible in a true spirit of international scientific co-operation?

The discussion of this subject, both in the Aerial Age and at the First International Congress of Aerial Navigation, has supplied enough elements to approach the problem of Standardization and Aerodynamics on some sort of well defined basis. It should not be difficult to co-ordinate the various suggestions made by the directors of the various laboratories and to find a common ground on which an agreement might be reached. This can be accomplished mostly by correspondence. After an agreement has thus been reached on general lines, a meeting of American and European representatives of aerodynamic laboratories and leading scientists engaged in Aeronautical research work could be easily arranged for. A meeting of this sort bringing together scientists of all nations, which on account of the war find themselves separated by nationalistic barriers, would make it possible to work out the details for carrying through a program of immediate and future actions and, furthermore, would supply the human factor as represented by the personal contact of men having the same object in mind: the progress of science.

Let Us Have Peace

In spite of the war, in spite of the tremendous turmoil of hate, lust and avarice, in spite of the re-awakening of all the baser instincts of the human race which the war has unchained, we can see the signs of a new era dawning upon us. Social reforms based on the old standards of personal and nationalistic advantages shall never restore peace and order, unless we realize first the true meaning of the law of brotherhood and stand ready to compromise on the matter of personal rights, privileges and advantages in the interest of all.

The intellectuals of the world, scientists and technical men engaged in the work of developing and perfecting new inventions are the pioneers of this new era. It is up to them to realize the meaning of the divine love, of which science is the noblest expression, and it is up to them to give the example and to teach the objective lesson that the world needs: The unselfish co-operation of all in the realization of a common good.

Aeronautics and the enormous possibilities offered by aeronautics, which represent the outstanding engineering progress born out of the war, points out the way to us where international co-operation of scientists and technical men starts.

We have in aeronautics a new science, a new branch of engineering, a new and fundamentally international means of communication. The men who are working in aeronautics are new men, they understand the need of co-operation, they are ready to co-operate with each other, they invite the leadership of a group of progressive scientists of a progressive nation to bring about the formation of a nucleus of the great brotherhood of the intellectuals of the world.

Can I be blamed for continuing, after three years of efforts (not fruitless by any means) to look upon our National Advisory Committee for Aeronautics as the best adapted Aeronautical organization in the world for bringing about the desired results? Especially so when we consider that the Committee is in sympathy with the idea of an international congress of scientists working in aeronautics and would be ready to join in a discussion leading to a better understanding of wind tunnel work and to the Standardization of Symbols, notations and methods of graphical representation used in technical aeronautical works, if it was not prevented from doing so by the stand taken by Congress on the matter of American participation to International conferences.

Only last September a pathetic appeal was sent by German and Italian Scientists working in aeronautics to scientists of other nations to take part in a meeting held at Innsbruck (Tyrol)—The invitation read: "The research work of the last years has brought about in all countries considerable progress in the development of the classical theories as well as of the fundamental problems of practical hydraulics and aerodynamics. On account of political events the interchange of ideas and personal intercourse among Scientists have been impaired. By the said meeting we intend to avoid whatever hinders at the present time the success of official international Congresses. We simply want to rally without any formalities the scientists interested in these special problems."

American, British and French Scientists did not answer the call of their German and Italian brethren, not because they did not want to, but because they could not on account of the unfortunate preponderance of political consideration over other considerations of higher nature. This seems to be the price that scientific research work in aeronautics must pay nowadays in order to obtain the scanty credits granted by the various governments for that purpose.

It is rather amusing to see that, of all governments subsiding scientific research work in aeronautics, the German government should be the first one who has not opposed its veto to the action taken by Prof. Prandtl and by Prof. Karman in calling this first international congress of scientists working in aeronautics.

An Appeal to the National Advisory Committee for Aeronautics

I wish to close the present discussion of the subject "Standardization and Aerodynamics" by appealing once more to the members of our National Advisory Committee for Aeronautics urging them to use their personal influence and the enormous prestige of the finest aeronautical Scientific organization in the world, for obtaining from Congress the recognition of the fact that a wider range of independence from political considerations by that Committee in the field of international co-operation in the interest of the scientific progress of aeronautics is worthy of the high standards of that institution and is consistent with our national interests.

The first step along the road of collaboration with Europe in the work of reconstruction (which, no matter if we like it or not, we shall have to travel sooner or later) it is just and right that it should be made by American Scientists. Such a step would be entirely consistent with the desire repeatedly expressed by the nation, the President and by members of its Cabinet, to co-operate with European Nations in any constructive plan leading to the re-establishment of peace in the world.

Who can suggest of any better plan leading to the re-establishment of peace in the world than the one brought about by promoting an increased collaboration between Scientists and technical men all over the world? And if the initial move in that direction can be made by promoting peace and collaboration between scientists working in aeronautics who are ready and eager to fulfill the law of international brotherhood, why not let aeronautics lead the world along the path of intellectual evolution on which, in spite of all adverse, forces we are steadily progressing?

Why short sighted and short lived political considerations should deprive this nation and our National Advisory Committee for Aeronautics of the great privilege of being able to make the first move?

Quoting President Harding's Words

The words spoken by the President at the Commemoration of the fourth anniversary of the Armistice truly represent the sentiment of the great majority of the American people on the matter of co-operation with Europe:—

"I think we have come to realize, as a nation, that we cannot hope to avoid obligations and responsibilities, often arduous and burdensome, as part of the price we must pay for our fortunate relationship to the confraternity of the nations. It will be greatly to the national benefit, I am sure, if those who most intimately participated in the events of the great world, and among them I, of course, include particularly the men of the overseas forces, shall always keep in mind the fact that their noble service to their country and civilization has imposed upon us a duty to recognize that henceforward we must maintain a helpful and sustaining attitude in all the broader relationships that involve the nations. Our first duty will, indeed, be to our own, but that duty cannot be adequately discharged in narrowness and selfishness.

"That we may be guided to a just judgment of the time and occasion for further proof of our interest in the common cause of humanity, and in choosing the methods whereby to discharge the obligation thus created, will be, I am sure, a fitting prayer for this armistice anniversary."

Let us keep in mind that we can help making this world safe for democracy in one way only: by taking our share of obligations and responsibilities in building up a new International: THE INTERNATIONAL OF BRAINS AND HEARTS.

TABLE IV

Evaluation of Thrust and Torque for Secondary Conditions :

Station	2	3	4	5	6
Radius	2.00	2.67	3.33	4.00	4.67
2 —r n	314	420	523	628	735
tan Ø	.3180	.2383	.1910	.1590	.1362
cos Ø	.9530	.9727	.9822	.9876	.9909
Ø	17° 38′	13° 25′	10° 49′	9° 2′	7° 45′
k	.0366	.0366	.0366	.0366	.0366
x°	—72.°	—8.2°	—6.2°	—5.2°	—4.2°
Do — Ø	19.5°	18.4°	14.8°	12.3°	10.3°
O	5.6°	4.6°	3.6°	2.6°	1.6° (approx.)
x	6.7°	5.6°	5.0°	4.5°	4.5°
CL	.495	.500	.420	.360	.330
L/D	12.65	13.65	14.50	16.50	17.00
J	4° 31′	4° 11′	3° 57′	3° 28′	3° 22′
Ø′	23° 14′	18° 00′	14° 25′	11° 38′	9° 21′
tan Ø′	.4293	.3249	.2571	.2059	.1647
sin Ø′	.3945	.3090	.2490	.2016	.1625
Ø′ + *J*	27° 45′	22° 11′	18° 22′	15° 6′	12° 43′
tan (Ø′ + *J*)	.5261	.4078	.3320	.2698	.2257
cos (Ø′ + *J*)	.8850	.9260	.9491	.9655	.9755
V (1 + ½a)	126.5	132.0	132.0	128.0	120.0
aV	53.0	64.0	64.0	56.0	40.0
2 — m b	27.8	26.1	21.2	15.1	9.0
dT/dr	84.5	167	205	210	181
dQ/dr	89	182	227	226	191

TABLE V

Determination of Propeller Characteristics and Evaluation of Useful Power

J	Tc	Qc	K (*M*)	n	V	Pm	Pu
.30	.0827	.00965	45.0	1480	50.5	347	160
.40	.0750	.00827	58.0	1510	68.5	350	202
.50	.0645	.00765	67.0	1570	89.9	371	248
.60	.0517	.00673	74.7	1670	114.0	389	291
.65	.0445	.00613	75.2	1755	129.8	418	314
.70	.0367	.00545	75.1	....	.....	...	...
.80	.0193	.00370	66.5	....	.....	...	...

General Rules For Air Combat

A Post-war Paper on Pursuit Aviation by an Expert German Pilot—It Visualizes to the Lay Reader What Pursuit Aviation Means to the Sohrabs and Rustums of the Air

Surprise and Attack Regardless of Consequences:

The combating power of the one-seater lies in the attack. In an attack, the surprise and a fearless closing with the opponent as near as possible (less than 100 meters) before the opening of fire, play the chief part. The one-seater makes his surprise attacks, flying out of the sun, toward the enemy, or in the steepest dives.

Proper Shooting Distance

The one-seater is only at the proper shooting distance when he flies into the enemy's propeller whirlwind and constantly has the feeling that he will ram the opponent at once. At such distances the large and close target must be hit by using the gauger and sights even with aiming errors; with the employment of light tracer ammunition the position of the stream of bullets can be frequently improved. The use of the aiming telescope at such short distances is not advisable. Firing at longer distances with the aiming telescope is solely to be used to shoot at a fleeing opponent—to force him, through short bursts at greater distances, to circle and to then cut him off while circling—or to help in time a far-away harassed comrade.

Attacking Direction.

The most effective attacking direction against one-seaters is the one from above to the rear, to the rear and from the rear below. Shooting the opponent from the front is in most cases not possible with the short shot possibility due to the speed of the aeroplanes and the blanketing of the pilot by the engine. An opponent, who shoots while swooping down from a great distance, betrays the beginner or shows shyness to engage in the curve combat at a close distance. Even accidental shots are herewith rare.

Working Together.

Fundamentally two one-seaters should always co-operate even in squadron formation. If one of the two attacks a hostile one-seater, his comrade does not take part in the air combat, but remains in readiness for immediate action and covers the rear back of the comrade against a surprise attack by other hostile aeroplanes. Only then is participation in the combat proper, if the opponent threatens to win the upperhand. The attacked aeroplane is, if it does not burn or break up, always closely pursued till its impact or landing. Turning away from the opponent on account of inexperience or in consequence of hostile action, even if only for seconds, means for the comrade in the vicinity not only the right, but also the duty to take part at once. Herewith the fundamental rule remains, never to impede the curve combat of a comrade by a desire to open fire.

The Opening of the Combat.

With a prompt recognition of the hostile aeroplane turn at once against it, shoot and then try in curve combat to get in the rear or underneath him (if opponent has a rotating motor turn to the right if possible.)

When in doubt as to whether it is a hostile or friendly aeroplane, turn against it at once, push underneath the suspicious machine at full speed and only, if the cocard is recognized or opponent shoots, to pull high and return the fire. With a surprise attack from the rear, if there is no time to turn around, tip up steeply at once with full gas, once again pull up high and go into the curve or immediately with the most powerful rudderpush take the steepest curve.

Curve Combat.

In curve combat the curve must not be changed or downward steering be given, if the opponent ascends above. Herewith there is still the possibility of shooting the opponent from below, as it is not at all advisable, to go above an aeroplane, which can shoot upwards. The curve combat itself is always led with full gas. If the one-seater perceives, that in spite of his efforts the enemy will come behind him because of greater turning ability of his aeroplane or flying superiority, then quickly overdraw the machine in the curve, whereupon it stands at once on its head, turns 3 to 4 times quick as lightning round its own axis, and catches itself again on its own accord after a sudden fall of 100 meters at the most. The pursuer is in this way always shaken off for some time.

Rear Cover.

The one-seater operating alone over hostile territory is easy to combat, when fearlessly attacked, as he lacks the rear cover on the one hand, and on the other hand must strive again to reach his lines. Therefore, with attacks on captive balloons and in squadron combats beyond the front, constant team work is absolutely necessary. This supplies the necessary defense for the rear attack. Frequent practice is, however, necessary.

Combat of the One-Seater against Hostile Double-Seaters.

Herewith too, the surprise plays the chief part on our side and on the other side of the lines, besides making possible a quick rush across the danger zone of the enemy's movable machine gun. Suddenly push down in the steepest drop without shooting, place oneself at once behind or underneath the enemy and only at the last moment operate both rigid machine guns. A flat straight-ahead flight with an attack on the body of the double-seater is absolutely to be avoided. It is wrong to shoot in an attack at distances of over 100 meters and if the opponent answers the fire, to turn. In this moment the enemy is offered a target which is easily hit and without danger to him.

Combat of the Double-Seater against Hostile One-Seaters.

With early recognition of the opponent give the observer notice, while still at a long distance, by short fire bursts, so that he will not be surprised (thus saving ammunition). If the hostile one-seater attacks, then curve with full gas and bring observer into position to shoot.

In case of doubt, whether it is a hostile or our own aeroplane, curve towards it, press underneath it with full gas and, if the enemy is recognized, bring observer into position to shoot from beneath to above.

With a surprise hostile attack at once curve steeply with most powerful rudder stroke, bring the observer into position to shoot. It is fundamentally wrong, to fly straight ahead or—when with shut off gas—to go straight ahead downwards.

The German reconnoitering aeroplane attacked by hostile one-seaters far beyond the line rids himself best of his bothersome opponents, by flying constantly zigzag, as long as the enemy attacks, thus bringing the observer into position to shoot. If the pursuer is lost out of the line of sight for a moment the German double-seater then at once pushes away under full gas and takes advantage of the high speed of the heavy aeroplane. Generally the pursuer does not succeed in overtaking a second time and approaching in an effective distance (50 to 100 m.). Should the one-seater still follow, shooting at 4 to 500 meters, then do not curve nor return fire, but first, quickly put in new drums, turn, push beneath the pursuer and to bring observer in closest distance to shoot upwards. Fundamentally the most dangerous one-seater is the one which tries to get underneath the tail of the double-seater.

Combat of the Double-Seater against Hostile Double-Seaters.

Here the movable machine gun of the observer brings the decision. The task of the pilot herewith is, to bring his observer as often as possible into position to shoot and to curve in such a way that the opponent is offered no aim. An attack of the double-seater with the rigid machine gun will often stupefy the opponent. On our side of the lines the double-seater has also the duty to attack as well as to take part in the air battle of German one-seaters in the vicinity.

AERIAL AGE

PUBLISHED MONTHLY

Copyright, December, 1922, by THE AERIAL AGE CO., INC.

5942 Grand Central Terminal, New York

Vol. XV DECEMBER, 1922 No. 21

Night Flying for the Air Mail

DURING the next few weeks the Air Mail will try out aerodrome lighting equipment from various manufacturers at fields every 25 miles along the course from Chicago to Cheyenne. This, in order to determine the best system for the purpose.

Each field will be equipped with a beacon which will have a visibility of approximately 35 miles. The fields themselves will be lighted by means of floodlights to illuminate the landing Ts and by boundary lights to determine the field limits. All buildings will be floodlighted to give, as near as possible, a day-time perspective and in every instance the lighting arrangement will be such that the lights will not shine in the pilot's eyes.

The Post Office believes that the lighting of the 'plane itself is by far the more important item. One of the Post Office 'planes is being fitted with electric landing lights by the Army Air Service at McCook Field.

Transcontinental Flying

THE army aviators who drove a monoplane from California to Indiana before they were compelled to alight missed their goal of a non-stop flight from ocean to ocean. But in flying two-thirds of the desired distance and the more difficult country without a descent in twenty-eight hours they proved the entire feasibility of the project. The hardy flyers who make the next attempt may reasonably expect to find it free from the handicap of a leaky radiator and burned-out engine.

At least there are the best of assurances that the feat will be accomplished in time and probably in the near future. A generation to whose fathers the pony express and the first locomotive across the plains were marvels of fast transportation can hardly be so surfeited with the exploits of aviation as not to feel a new thrill at the near prospect of flying across the continent in a continuous trip. As it is, the performance of Lieuts. Macready and Kelly is both a record-breaking achievement as a sustained flight for 2,060 miles and a notable example of resourcefulness in overcoming the obstacles of violent storms, mountain cross-winds and mechanical hazards. It is one of the great feats of aviation and comparable as a contribution to the development of long-distance flying with the high-speed records for short distances made at the recent Detroit contests. How far away is the Coast-to-Coast Air Limited, to cover the route, on the basis of the Pulitzer Trophy speed records, in from twelve to fourteen hours? (Editorial in N. Y. World.)

Oxygen and Commercial Flying at High Altitudes

THE question of commercial flyin under federal regulations, as proposed in a bill now before Congress for the creation of a Government "Bureau of Civil Aeronautics" is becoming of more immediate and definite interest to promoters of transportation lines, to engineers, insurance companies, pilots, business houses and to the traveling public on whose patronage success depends.

Economy is, perhaps, the first consideration. This means flight at high altitudes, probably at twenty-five thousand or more feet. How, then, are we to breathe comfortably and can we be kept warm? The attainment of high altitudes and the use of the heat available is now the solved problem of the supercharged engine.

However, some light on the medical aspect of high flying is shed by the research work for the National Advisory Committee for Aeronautics by Franklin L. Hunt on the subject of oxygen instruments, which have been employed thus far in the flying at great altitudes.

It has been shown that at altitudes above 15,000 feet the physical condition of aviators—and of the traveling public—is affected by lack of oxygen, unless artificial means is provided to supply the deficiency.

The physiological symptoms are: headache, which is usually the first noted; palpitation, fatigue, numbness of the limbs, pains in one or both ears, weakening of the attention, diminished sense of stability, which means much to the pilot; vertigo, faintness, and finally, loss of consciousness. It is obvious that the existing altitude records have been made with the assistance of someone or another oxygen apparatus.

It has been definitely determined that flying at altitudes of 20,000 feet or more for extended periods can not be undertaken without serious injury to the central nervous system of the aviator.

These physiological symptoms can be almost entirely avoided by supplying artificial oxygen during flight.

The normal man at full atmospheric pressure breathes approximately 16 times a minute. The volume of each inspiration is about one-half liter, so that 8 liters of air is breathed per minute, of which 1.6 liters is oxygen. This, however, is the minimum required. In the case of the pilot of an aircraft, the aviator is continually in a state of physical activity and, therefore, needs more oxygen. It has been found that 4 liters of oxygen per minute is not an excessive amount to supply, allowing for inevitable losses.

The pressure of the air at sea level is approximately 14.7 pounds per square inch. It decreases at the rate of approximately one-half pound per square inch for every 1000 feet of altitude for the first 10,000 feet and more rapidly thereafter. At 20,000 feet the pressure, and consequently the density, is only one-half that at the surface of the earth. Consequently, the traveler would obtain but one-half the normal supply of oxygen at each inhalation.

For high altitude flights it appears that approximately 150 liters of artificial oxygen must be supplied per person per hour, and under average present conditions a supply for a 2½-hour flight is carried. This oxygen is stored either in bags in the fuselage of the machine compressed in steel cylinders or liquefied. From the containers the oxygen is supplied to the pilot through reducing and regulating valves, a flow indicator and tubing to a mask worn over the face.

With the inauguration of high-altitude, high-speed long-distance airplane lines, one may expect air tight

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THE NEWS of THE MONTH

Aerial Photography and the Oil Fields

The airplane has been put to one of its most novel uses in the taking of pictures for a mosaic of the Salt Creek and Teapot oil fields in Wyoming. This unusual photographic feat was performed for the Bureau of Mines by the Air Service of the Army. An area of 336 square miles was photographed. The pictures were taken from an elevation of 15,000 feet above sea level on films 100 feet in length. It required in the neighborhood of 450 pictures and 16 hours flying time to cover the area. Some of the richest oil bearing reserves on the public lands of the United States are included in this area.

A Veteran Pilot

Probably the oldest aviator in the world, Colonel C. C. Dickinson of Chicago, 62 years old and a pilot, recently left Washington en route for Chicago on the last leg of a remarkable flight. The Colonel, in his Laird-Swallow aerial knockabout, flew from Chicago to the recent Aviation Meet at Detroit and, following the Pulitzer Trophy Races, hopped off for a trip to Florida, stopping over one day on the return flight to visit the National Headquarters of the National Aeronautic Association in this City.

Colonel Dickinson, then 50 years of age, was taught to fly in 1910 by the famous British pilot, Claude Grahame-White, who visited this country for the Gordon-Bennett aerial races of that year. Since that time the Colonel has been an aeronautical enthusiast and a supporter of the progress of commerical aviation in this country. He took an important part in the deliberations of the Detroit Aeronautical Congress, and was a much interested observer of the Pulitzer Races.

On reaching Chicago Colonel Dickinson will have completed an aerial tour of 3,510 miles which, for a man of his age, might seem remarkable, but the Colonel considers it nothing unusual in view of the present reliability of American aircraft, and the luxurious comfort of traveling by air.

Amundsen Plans Flight for May

Captain Roald Amundsen plans his flight Wainwright, Alaska, across the north pole next May or June, according to Captain C. S. Cochran of the Coast Guard cutter Bear, which was in Seattle recently after a long voyage into the Arctic Ocean. Captain Amundsen, who left here in the schooner Maud in June, spent much time aboard the Bear in the arctic. Ice in the arctic is the worst since 1906, Captain Cochran reports. Captain Amundsen intends to go to Nome, Alaska, this Winter by dog team, and to return to Wainwright for his flight with Lieutenant Oskar Omdahl, he told Captain Cochran.

Aeronautical Safety Code

In accordance with a request from the Sectional Committee for the American Aeronautical Safety Code, the National Aeronautic Association of U. S. A. has appointed its Vice-President, Bernard H. Mulvihill, and Col. Harold. E. Hartney, its general manager, as members of the Committee.

This Committee today finished its deliberations at the U. S. Bureau of Standards, Washington, D. C., where, for the last two days, together with various Sub-committees, it has been formulating an Aerial Safety Code which shall be a basis for the manufacturers and operators of aircraft in this country to introduce into their activities every measure of safety which engineering practice and operating skill can devise. The whole object of this aeronautical code is to standardize and codify, for the use of such manufacturers and operators, the best possible methods which aeronautical knowledge, at this stage of development, can produce, in exactly the same manner as the manufactures of electrical equipment, automotive engines, and other mechanical industries employ safety codes.

The Sectional Committee is headed by H. M. Crane, M. E., Chairman, formerly of the Wright Aeronautical Company; Dr. J. S. Ames, Head of the Mechanical Engineerng Department, Johns Hopkins University, and Member of the National Advisory Committe for Aeronautics, Vice-Chairman; Dr. M. G. Lloyd, E. E., of the Bureau of Standards, Secretary; and Mr. Arthur Halsted, E. E., of the Bureau of Standards, Assistant Secretary. The representation on the Committee are prominent members of the following organizations:—

National Aeronautic Association of U. S. A., Inc., Manufacturers Aircraft Association, Aero Club of America, U. S. Bureau of Standards, Society of Automotive Engineers, American Society of Safety Engineers, U. S. Post Office Department, National Aircraft Underwriters Association, U. S. Weather Bureau, American Institute of Electrical Engineers, National Safety Council, Underwriters Laboratories, U. S. Coast Guard, Rubber Association of America, American Society of Mechanical Engineers, American Society for Testing Materials, U. S. War Department, and the U. S. Forest Service.

The working out of the safety code has been placed in the hands of special Committees—viz.,

Sub-committee on Airplane Structure.—Dr. E. P. Warner, Supervisor of Aeronautics, Massachusetts Institute of Technology, Chairman.

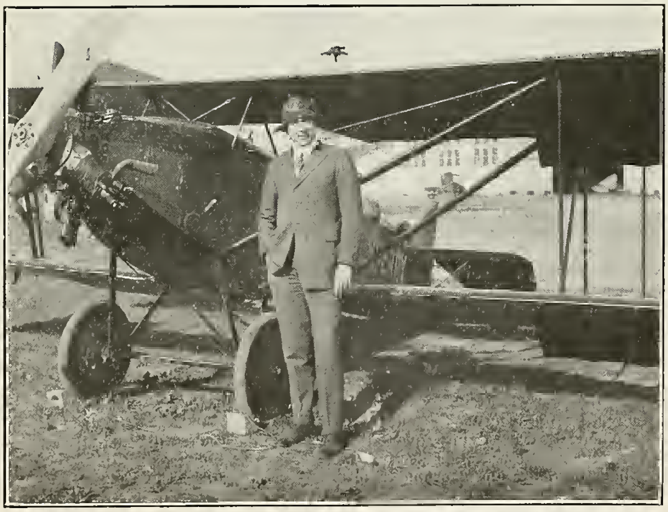
Sub-committee on Power Plant.—George J. Mead, Wright Aeronautical Corporation, Chairman.

Sub-committee on Equipment and Maintenance of Airplanes.—Archibald Black, New York City Aeronautical Engineer, Chairman.

Sub-committee on Lighter-than-Air Craft (Balloons, Airships, Parachutes.)—Ralph H. Upson, Aeronautical Engineer, Detroit, Michigan, Chairman.

Sub-committee on Airdromes and Traffic Rules (Landing Fields, Airports, Traffic Rules, Signals, Qualifications for Pilots)—Arthur Halsted, Associate Electrical Engineer, Bureau of Standards, Washington, D. C., Chairman.

This Committee has practically completed the codification of safety rules for all of the activities covered by the Sub-committees, which has been a monumental work, but will be undoubtedly the basis for complete co-operation between all agencies engaged in every phase of aeronautics in making air navigation safe, not only from the standpoint of the pilot, but of passengers and public and private property. It has been felt by all these engineering societies that a safety code should grow up with the development of the industry which can be used by aeronautical and operating companies, manufacturing companies, and even by municipalities and states in formulating regulations covering the manufacture and use



John Prest, Vice-President of the First National Bank, San Antonio, who journeyed from New York to San Antonio, Texas in a Sperry Sport Plane.

of aircraft within their jurisdiction. In this way there will be uniform measures taken, rather than disjointed and conflicting laws, regulations and rules promulgated by forty-eight states, and no one knows how many municipalities.

This activity of the Committee is not an effort to force upon aeronautics discriminatory and retarding rules, but to assist in the development of the science in America in such a way that public confidence in the safety of air navigation will be built up, and that the code itself will be one contributing effort in placing "America First in the Air."

J. V. Martin Patents

Important to those interested in aeroplane efficiency:—The Jas. V. Martin aeroplane patents—

Retractable Chassis June 17th, 1919—May 30th, 1922 and Oct. 3rd, 1922—others pending.

Aeroplane Transmission, Mar. 3rd, 1914 Paul Zimmermann and July 4th, 1922 to J. V. Martin others pending.

Internal contained shock absorber wheel, Oct. 24th, 1922, others pending, etc. Martin Aeroplane Factory, Garden City, N. Y.

Plane to Carry Sportsmen on Hunt in Arctic

Six sportsmen intend to leave this city next summer by flying boat for a hunting trip in the northern Hudson Bay region of Canada. The arduous journey afoot and by canoe through a wilderness swarming with mosquitos will be avoided and they expect to pass not more than seventy-two hours in actual travel, although the time consumed by the journey will be much longer, owing to stopovers.

The men who will make the trip are I. M. Uppercu, president of the Detroit Motor Car Company of New York; Howard E. Coffin, vice-president of the Hudson Motor Car Corporation and president of the National Aeronautic Association; Harold H. Emmons, president of the Detroit Board of Commerce; Dr. James W. Inches, Police Commissioner of Detroit; William E. Metzger, president of the Detroit Club, and Charles F. Redden, president of the Aeromarine Airways, Inc.

The Aeromarine Airways, Inc., is building for the trip a flying boat which will be equipped with beds, an electric range and radio. The observation compartment in the bow will be completely inclosed. The wingspread is to be 104 feet and two 400-horse-power Liberty engines, capable of making 100 miles an hour, will be installed. The machine will weigh seven and a half tons. The hull and cabin of the boat are almost finished.

The Canadian government has given its approval to the flight, and arrangements have been made with the Hudson Bay Company for the use of its posts as service stations. Montreal probably will be the first stop. Thence the voyagers will fly westward to the Ottawa River which, with a chain of lakes, provides a water thoroughfare to James Bay, a southerly arm of Hudson Bay. The route thereafter will lie across Hudson Bay.

Virtually the entire route is above waterways, which will facilitate landing in case it becomes necessary.

"The idea of flying to the Hudson Bay district came to me recently," said Mr. Redden, "when I was flying over the Province of Quebec. I was impressed with the fact that there are innumerable lakes and rivers affording an almost continuous waterway and landing field from New York to the Arctic Circle.

"Upon further investigation I found that traveling by dogsled or canoe, according to the season, a trip to the Hudson Bay region takes from six to eight weeks, and this means six or eight weeks of hardship too strenuous for any but the most experienced woodsmen.

"This led to the thought that inasmuch as the Wall Street banker and business man was going to the ends of the earth seeking new amusements it would be a good idea to take a party of sportsmen from New York into this northern territory."

Aeromarine Opens Southern Air Routes.

The first flight of the 1922-1923 season between Key West and Havana was made November 8th by the aeromarine 11 passenger flying boat SANTA MARIA. On the initial flight, the SANTA MARIA carried eleven passengers including C. F. Redden, president of the Aeromarine Airways, Inc., and Major B. L. Smith, General Manager.

On their arrival in Havana, the party received an enthusiastic reception. Prior to the reception, the president of Cuba had designated the Cuban Secretary of War Secretary of the Navy and the Secretary of State as his representatives and after the arrival of the SANTA MARIA these officials accompanied by C. B. Hurst, American Consul General in Havana made a flight in the SANTA MARIA above Havana and circled Morro Castle several times.

Mr. Redden made public in Havana the fact that the Aeromarine Company had already made plans to inaugurate a regular schedule from New York direct to Miami in the winter of 1923.

"We have had this service under consideration for the past two years and we have proved that we can take passengers aboard in New York after breakfast and get them into Miami in time for supper. This will be possible by relay work. For instance, one of our big 11-passenger air cruisers will go down the coast half way and there at some convenient airport, the passengers will be transferred after lunch into a scond aeromarine flying boat which will continue on down the coast."

The SANTA MARIA is the queen ship of the Aeromarine Airways' Black Tail Fleet. During this past summer the SANTA MARIA was one of a fleet of four 11-passenger enclosed cabin flying noats operating between Cleveland anu Detroit on a double daily schedule.

Aero Club of Pennsylvania

The stated monthly meeting of the Club was held at the Air Field at Media, Pa., on October 21st. A large number of the members were in attendance. It was announced to the members that the Aero Club of Pennsylvania was represented at the recent Aero Congress by W. W. Kellett, a director of the Club.

The following pilots entered the Detroit races as Service Members of the Club. Captain St. Clair Streett, Lieutenant E. C. Whitehead and Lieutenant C. L. Bissell.

One of the important subjects which was discussed at the meeting was a method of making a drive for new members. It is felt that there are many people in and near Philadelphia, who are either directly connected with the industry or who are interested in aviation who would join the Club if same was brought to their attention. It is important that we make an effort to enroll them in order to give them the opportunity and benefit of our Aero Club associations, and direct contact with the National aeronautic development and flying events.

Plans are being made so that at sometime in the near future, inspection trips will be arranged for members of the Aero Club to go through both the Naval Aircraft Factory at League Island and the dirigible hangar at Lakehurst, N. J., where the ZR-1 is under construction. Trips of this nature will do much to arouse interest and will give the members an opportunity to see the very latest in aircraft development.

Philadelphia must quickly develop a municipal landing field for airplanes if it does not desire to fall behind other large cities of the country, and eventually be passed by when the development of commercial aviation becomes more general. This is the substance of the recommendation made to the Philadelphia Chamber of Commerce by C. T. Ludington, delegate of the local body to the Second National Aero Congress in Detroit from which Mr. Ludington lately returned. W. Wallace Kellett, a member of the Chamber of Commerce Aviation Committee also attended the meeting. Mr. Ludington pointed out that Boston, Chicago, Kansas City and now Pittsburgh are providing landing facilities. A suitable landing field is an absolute necessity in Philadelphia.

The Media Air Field on which the club met on October 21st contains over one hundred acres and was turned over to the United States Government by the Media Business Men's Association to be used for military aviation purposes. Over twenty-five planes joined in the exhibition featuring the ceremonies. Governor Sproul addressed the 4000 persons who had gathered at the field to witness the dedication.

The Governor congratulated the business men's organization on its industry and public spirited interest. C. Frank Williamson, president of the association made the presentation. It had been expected that General Mason Patrick, head of the United States Army Air Service, would be on hand to accept the field as one of a series for army use. He was unable to attend and in his absence Major Brooks of Mitchell Field accepted the aviation field for the army. The flying field is on the Baltimore pike east of the borough of Media. It will be the western airgate of Philadelphia and is on the air route from Washington to Long Island. Planes were flown from Mitchell Field, Aberdeen and Bolling Field, Washington. More than two hundred army pilots took part in the event.

The army blimp, the D3 was anchored on the field and aroused much interest. Many types of planes including DH-9, DH-4, a Martin bomber, JN-4 and a Curtiss Oriole were on the field. Most of the planes used by the army pilots were driven by the famous Liberty motor. Following the official dedication the planes again took the air and gave an exhibition of formation and stunt flying. Later in

(*Concluded on page 611*)

THE AIRCRAFT TRADE REVIEW

Aeromarine Airways Making Remarkable Progress

A communication received from the Aeromarine Airways states that its New York Division during the period commencing May 14 and ending October 22, 1922, carried 2,380 passengers, and that the Great Lakes Division, operating between Cleveland and Detroit, in the period commencing July 17 and ending September 17, 1922, carried 1,873 passengers. These figures are exclusive of crews. It is further stated that in 2½ years, the Aeromarine Airways carried over 17,000 passengers and covered more than 1,000,000 passenger miles, without a single serious mishap or injury to the passengers; also that during the past summer they had investigators in Europe who reported that, as far as comfort goes, Aeromarine flying boats are superior to any type of aircraft now operated on the European air lines.

In conclusion, it is stated that, so far as flying boat travel is concerned, the United States leads all foreign countries.

Taught to Fly in One Day

On September 22nd, 1922, Kenneth M. Lane, a student of the Dayton Wright Airplane Company, and who had never previously touched the controls of a plane, started to take instruction early in the morning, and that evening made his first solo flight. His total instruction time was four hours and twenty-six minutes, the remainder of the day being spent in ground instruction and resting.

The purpose of this experiment was to demonstrate the advantage for teaching and the superior flying qualities of the Dayton Wright "Chummy," a plane designed primarily for training, by Colonel V. E. Clark, chief engineer of the company and well known in aviation circles. The decision to conduct such a test was made as a result of numerous inquiries from prospective students as to how many days it would require to learn to fly.

Mr. Lane, who is 26 years of age, was chosen for the test because of two qualities which he possessed; education and an interest in athletics. The nature of his education was such as to develop mental alertness, while participation in athletics had developed the endurance necessary for the long day's grind.

The instructor, Walter E. Lees, since he started flying in 1915, has tested and instructed on many types of planes. The method of instruction employed has been worked out as a result of long experience and is a feature of this training school.

The plane itself is a two side by side seated biplane with a LeRhone rotary engine of 80 horse-power It is ideal for such work because of excellent flying qualities and the side by side seating arrangement which enables the instructor to observe the student continuously and conveys greater confidence to the student, because he knows at all times just what is happening and is told at the very moment why it happened.

Lieut. W. H. Brookley of McCook Field was official observer for the day, and Mr. C. F. Kettering, Mr. H. E. Talbot, Colonel Clark and others were interested observers that evening when Mr. Lane made his solo tests.

The Dayton-Wright Suit

In connection with the statements issued to the press at Washington to the effect that the Department of Justice has commenced suit against the Dayton Wright Airplane Company for the sum of $2,408,267.41 alleged over-payment by the Government on contracts for aircraft production, H. E. Talbott, Jr., President of the Dayton Wright Airplane Company today issued the following statement:

The officials of the Dayton Wright Airplane Company wish particularly to emphasize the following points as to which there can be no truthful denial:

First, the contracts in question were formulated by the Government itself;

Second, they were performed under the Government's supervision and strictly as required by it;

Third, all payments made were voluntarily made by the Government upon the basis of its own accounting and its own interpretation of the contracts;

Fourth, a settlement contract was entered into after the conclusion of the work and after an audit of the accounts;

Fifth, no complaint of any description was made by any representative of the Government for seventeen months after this settlement had been made;

Sixth, no complaint of overreaching or fraudulent conduct or falsification of accounts has ever been made;

Seventh, and lastly, the Company paid to the Government approximately seventy per cent of its profits in excess profits and income taxes, a payment for which, of course, no credit is given either in the Government's statements or in its bill.

This suit, so far as anyone connected with the Dayton Wright Airplane Company knows, concerns in all of its important aspects merely the interpretation of the contracts under which the Dayton Wright Airplane Company turned out a great number of airplanes and spare parts for the Government during the war. All of these contracts were formulated by representatives of the War Department.

During the entire time of production under the contracts referred to, the Government representatives approved all purchases, inspected all material received, audited and approved all invoices and payrolls, and before the company could be reimbursed by the Government it had to procure a voucher signed by the Government Officer in charge.

Upon the termination of the contract a final audit of the accounts was made by Government representatives, who allowed or disallowed the claims presented by the Company, and a final settlement was made in June, 1919, evidenced by a termination or settlement agreement dated June 11, 1919, duly signed by both parties and approved by the War Department Claims Board, Air Service Section, on June 23, 1919.

During the latter part of the year 1919 and the early part of 1920, an Accountant representing the Liquidation Division of the Air Service, with a number of assistants, visited the Company's office and spent several months checking the records of the Company. On November 4th, 1920, seventeen months after settlement, the Company was notified of the action of the War Department Claims Board, Air Service Section, claiming overpayment by the

Instructor Walter E. Lees, and student Kenneth M. Lane who was taught to fly in a day.

Government of $2,554,383.27, based on the general claim that certain of the contracts and contract provisions and the appraisal of the plant on termination of the contract were wholly or in part invalid in law, and the further claims that certain overhead items—principally special depreciation, representing the difference between cost of plant constructed for the purposes of the contract and the appraised commercial value of the plant at its completion (which value was fixed by a board of appraisers appointed one by the Company, one by the Government and the third by the two so appointed)—were improper charges to the cost of the 3,500 planes and large quantities of spare parts produced by the Company.

These payments and the appraisal had been made according to the provisions of the contracts between the Government and the Company and approved as fair and reasonable by the Government representatives who made the final audit and settlement in 1919.

The Government contentions, so far as they have been explained, are without exception based either upon pure technicalities or upon forced and finespun constructions of language which never occurred to anyone as intended by the parties or as possible until long after the contracts had been performed and settlements made. No claim of undue delay, poor work, overreaching, falsification of accounts or fraudulent conduct of any kind has ever been made by the Government.

Upon completion of the settlement the Company, having no reason to suspect that the Government officials would endeavor to upset the settlement contract, had made the regulation Income and Excess Profits Tax Return, and had paid approximately seventy per cent of the profit in taxes, so that in the event the Government should be successful in proving in court its claim that these contracts, properly executed by duly authorized officers of the Government, are invalid, and that the Board of Appraisers did not properly perform their duty, the Company would have a valid offset for seven-tenths of the amount claimed.

Regarding the assertion that the Board of Appraisers did not value the property at its commercial value, the Company has been unable to obtain from the War Department Claims Board or from the Department of Justice any intelligible explanation of its reason for this or, for that matter, of any other of its findings.

It is a fact, however, that both before and after the appraisal, it gave the Government a written offer to sell the Moraine property, the principal plant, to the Government at the appraised value, and this offer, which was not accepted, remained open for acceptance by the Government from March, 1919, to October 15th, 1919.

The Dayton Wright Airplane Company welcomes the suit threatened by the Government as the only way to arrive at a final disposition of the matter, being assured by its Counsel that its interpretation, being the interpretation placed upon the contracts by the Government Officials during the entire period of their performance, is correct. The Company feels equally assured that the later action of the War Department Claims Board and the Department of Justice, which, without explanation to the Company, attempts to rescind the action of the same Board taken a number of months earlier, is wholly without justification.

UNITED STATES POST OFFICE DEPARTMENT
AIR MAIL SERVICE
Consolidated Report of Operation
Fiscal Year 1922

Month	Gasoline Cost	Grease and Oil	Repairs and Accessories	Misc.	Motorcycles and Trucks	Rent, Light Heat, Power Telephone and water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing and Experiments College Park	Radio	Departmental Overhead Charge	TOTAL
July, 1921	$ 15,314.14	$ 3,377.71	$ 20,312.72	$ 9,759.07	$ 3,966.08	$ 1,209.05	$ 9,304.52	$ 5,357.08	$ 14,636.14	$ 13,912.18		$ 9,629.07	$ 3,021.35	$ 109,799.11
August	14,711.17	3,513.53	20,948.14	9,014.39	4,215.42	1,205.92	8,323.45	5,574.94	14,764.20	15,008.99	$1,253.03	5,571.22	2,882.58	106,986.98
September	13,530.82	3,232.78	18,742.45	8,690.28	3,941.77	1,725.59	9,280.02	5,415.87	14,329.58	14,773.75	763.31	5,772.40	2,799 83	102,998.45
October	13,858.03	3 065 53	25,881.32	10,924.35	3,831.34	1,532.59	10,765.41	5,749.65	15,513.58	17,093.25	743.11	10,447.26	2,800.09	122,205.51
November	12,657.50	3,060.19	26,380.19	8,480.47	4,107.96	2,530 96	10,312.85	5,769.61	14,903.85	17,464.04	656.24	8,193.56	2,900 09	117,417.83
December	12,116.94	2,717.64	31,513.17	7,868.73	5,050.69	2,920.92	10,539.83	5,809.06	14,666.63	14,705.01	604.78	6,955.35	2,795.95	118,264.70
January, 1922	11,352.66	2,385.52	32,545.25	8,630.80	3,?92.09	2,777.50	10,240.43	5,321.59	14,027.53	15,119.68		8,082.82	2,877.20	116,553.07
February	9,999.54	1,949.59	13,642.65	6,714 21	2,75?.?3	2,962.59	10,425.79	5,133.58	13,338 58	11,374.75		5,893.75	2,706.14	86,898.29
March	11,835.47	2,349.07	17,027.91	7,100.15	3,013.69	2,489.19	9,598.74	4,853.36	14,601.21	14,662.97		5,750.16	2,603.02	95,884.94
April	10,786 45	2,079.33	7,645.68	5,198.51	2,893,19	1,926.09	9,938.24	4,500.51	14,235.24	12,633.27		5,404.52	2,825.02	80,066.05
May	11,551.44	2,225.10	6,334.90	4,942.35	2,650.78	1,823.19	9,533.66	4,298.46	14,757.65	12,993.87		5,537.32	2,962.50	79,611.22
June	11,313 14	2,221.25	5,760.48	4,869.82	4,052.35	1,726.86	9,670.92	1,800.00	14,632 61	13,150.11		6,189.99	3,093.33	78,480.86
TOTAL	$149,027.30	$32,177.24	$226,735.18	$92,193.13	$43,672.29	$24,830.45	$117,933.86	$59,583.71	$174,406.99	$172,891.87	$4,020.47	$83,427.42	$34,267.10	$1,215,167.01

UNITED STATES POST OFFICE DEPARTMENT
AIR MAIL SERVICE
Consolidated Statement of Performance
Fiscal Year 1922

Month	Trips Possible (Scheduled)	Trips Attempted	Trips Defaulted	Trips Uncompleted	Trips Weather Encountered: Trips in fog, etc.	Trips Weather Encountered: Trips clear	Mileage Possible (Scheduled)	Miles Traveled With Mail	Miles Ferry and Test	Total Miles Traveled	Percent of performance	Mail Carried (Pounds)	No. of Letters Advanced	Cost of Service	Forced Landings due to Mechanical	Forced Landings due to Other Causes
1921																
July	624	623	1	6	65	558	131,450	130,555	18,129	148,684	99.31	77,276	3,091,040	$ 109,799.11	34	29
August	693	689	4	13	129	560	136,974	130,555	14,893	148,684	98.22	84,680	3,387,200	106,986.98	32	30
September	657	651	6	8	180	471	127,706	125,914	22,185	148,099	98 59	88,401	3,536,040	102,988.45	13	26
October*	714	707	7	7	166	541	140,080	138,759	20,212	158,971	99.05	99,057	3,962,280	122,205.51	23	21
November	672	633	39	46	285	348	131,520	117,529	25,616	143,145	89.36	93,519	3,740,760	117,417.83	17	74
December	726	660	66	37	266	394	142,240	125,416	15,840	141,256	88.17	101,198	4,047,920	118,264.70	42	46
1922																
January	699	633	66	32	191	442	136,880	119,966	17,721	137,687	87.64	93,283	3,731,320	116,553.07	31	44
February	635	558	77	15	210	348	124,960	107,944	10,140	118,084	86 38	92,902	3,716,080	86,898.29	24	28
March	729	690	39	22	269	421	144,720	134,503	16,161	150,664	92 94	123,212	4,928,480	95,884.94	13	57
April	675	652	23	16	276	376	134,000	127,634	6,369	134,003	95.25	116,202	4,650,100	20,066.05	17	69
May	702	694	8	8	235	459	139,360	136,973	12,312	149,285	98.30	121,888	4,875,520	79,611.22	17	46
June	702	697	5	1	161	536	139,360	138,185	9,770	147,955	99.15	132,904	5,316,160	78,480.86	18	9
TOTAL	8,228	7,887	341	211	2,433	5,454	1,629,250	1,537,927	189,338	1,727,265	94.39	1,224,723	48,988,920	$1,215,167.01	281	479

* Temporary Service from Elko to Ely, Nevada, inaugurated October 19, 1921.
** Last day service on Elko-Ely route, February 15, 1922.

PAUL HENDERSON,
Second Assistant Postmaster General.

(*table concluded on page 618*)

ARMY *and* NAVY AERONAUTICS

Army Pilot to Try for New Record.

Brigadier-General William Mitchell, assistant chief of the Army Air Service, has recommended to his chief, Major General Mason M. Patrick, that the National Aeronautic Association of U. S. A. through the Secretary of its Contest Committee, B. Russel Shaw, at once arrange the details for officially timing and recording the flights of two Army pilots in a speed contest the intention of which is to better the world's record for airplanes over a one-kilometer course. The pilots designated for the contest are Lieutenants Russell L. Maughan and Lester J. Maitland, winners of the first and second places in the Pulitzer Race recently held at Detroit.

General Mitchell himself is the present holder of the world's record which the new contest is expected to exceed, having piloted an Army-Curtiss Race at Detroit, on October 16, at the rate of 224.38 miles an hour over a straight-away course of one-kilometer. The General used the plane flown by Maitland in the Pulitzer Race and, following his record flight, tested the plane for maneuvring, afterward testing the other plane, piloted by the first-prize winner, Maughan, in the Pulitzer Race, in the same manner, that is, looping, barrel-spinning, tail-spinning, and climbing.

These tests, together with the fact that in the Pulitzer Race Maughan had flown his plane 250 kilometers over a closed course at an average speed of 206 miles an hour, and Maitland in his had averaged 203 miles an hour over the same course, the General states, led him to believe that with minor adjustments to wings and engines these planes would be capable of even greater speed performances than those made at Detroit.

In accordance with this belief, the General has recommended the new trials, and, while the two pilots may use any plane they may desire, it is a foregone conclusion they will select the two racers used at Detroit. Consequently, while arrangements are being completed between the Contest Committee of the National Aeronautic Association and the Army Air Service for staging the contest, the two planes in question will be overhauled and put into top-notch condition by Air Service mechanics.

Army Considering Round the World Flight

Tentative plans for an attempted flight of army airplanes around the world have been under consideration for some months by Air Service officials, it was recently learned, but the project has not as yet passed the preliminary survey stage.

Valuable data on available routes in both directions have been obtained, however, and ultimately it is hoped to send a considerable aerial squadron on the voyage. The project will not be laid before Secretary Weeks for approval, it was said, until it takes much more definite form. Two of the routes considered are that from the Atlantic coast via Iceland and Ireland, and that from the Pacific via Alaska, the Aleutian Islands, Siberia and home via Ireland and Iceland.

Air service officials said the route offering the most favorable conditions as to prevailing winds would be selected, should the flight be ordered, and it would then become necessary to obtain permission of each of the countries to be traversed before the squadron could start.

Army flyers conceived the world circling flight plan in line with the reasons which prompted President Roosevelt to send the fleet around the world in 1908, it was said. It would have value both as a step in providing aerial defense through training and in giving the world a better understanding of American post-war developments.

Flyers of other nations have undertaken, up to this time without success, world girdling flights, but only with a single plane, while the American air service project would call for a fleet of aircraft and careful preparations involving considerable expenditures.

Study of Taking Off and Landing

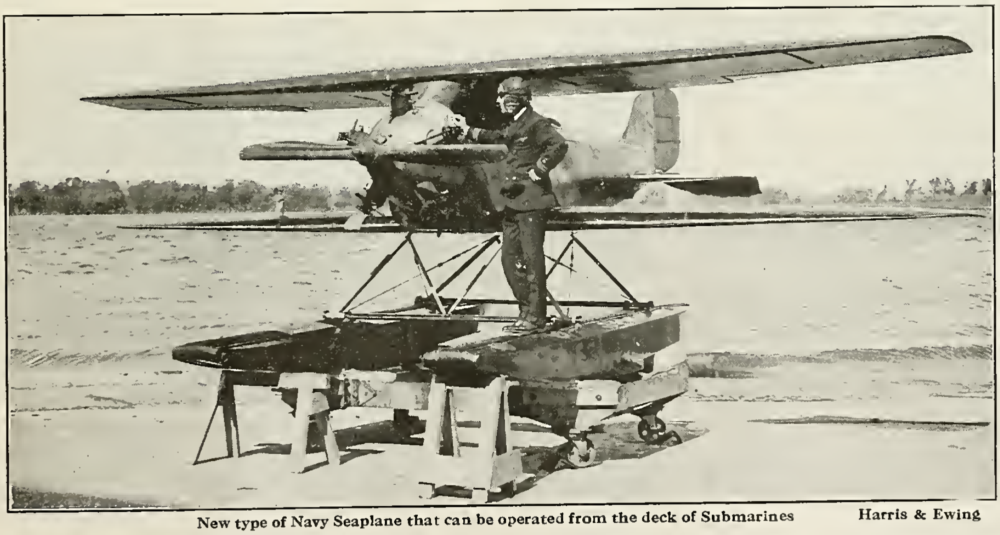
One of the best known systems of flight instruction leave "taking off" and "landing" until the last, until even the acrobatics have been completed. One authority states that the majority of all accidents are caused in getting away or in returning to earth.

Mr. Carroll has prepared a study which is to be published by the N.A.C.A. In this he points out that here is a determining guide to the efficiency of any pilot. His ability in landing and taking off is a direct index of his efficiency and, perhaps, his longevity.

Two of the new instruments developed by the N.A.C.A. were used in his work—the accelerometer and the control position recorder. These show on a photographic film the complete record of the shocks sustained by the airplane in pancake and in perfect landings. The other instrument shows in the same manner the simultaneous operation of the ailerons, rudder and elevator in the operation of leaving the aerodrome or returning to it.

The author says of the application of these instruments: "They reveal to even the skilled pilot startling facts as to his technique. It is surprising to see an accurate record of his every movement of the controls in the air and the fluctuation of the loading and air speed which have given him but fleeting impressions while he was in the air."

Up to the time of the development of these and other recording instruments by


New type of Navy Seaplane that can be operated from the deck of Submarines Harris & Ewing

the N.A.C.A., designers and engineers had to depend much upon the memories of test pilots as to the performance of a particular airplane. The pilots' recollections were often vague and they frequently disagreed as to the same airplane, due, perhaps, to the personal equation. Today, however, a review by the flier of the finished chart enables him to recall his actions, the response of the airplane, and give a comprehensive report, which frequently adds much to the delineations on the chart.

In a pancake landing, intentionally made by Carroll by levelling off about six feet or so above the ground, the record of the blow showed that the plane hit the ground with a force of 4.5 times the weight of his craft. In careful and regular landings this force seldom exceeds 1.5 to 2 times the weight of the airplane.

It will be the province of the proposed federal bureau of civil aeronautics to pass upon the fitness of pilots who may be employed in the transportation of the public. The control position recorder instrument visualizes the relative skill of pilots in the execution of any maneuver whatever. It equals the Wasserman test of the physician. The human element is a vital factor in the matter of insurance. This and other new instruments measure flying skill in figures.

Construction of New Airship At Langley Field

The erection of the Airship C-14 is rapidly nearing completion, even though several unexpected difficulties were encountered in its assembly. On "weighing off" the ship, it was found to be tail heavy, which necessitated the moving forward of the car suspensions. This did not materially alter the existing defect. The surfaces were moved forward as an alternate method of remedying the uneven distribution of weight and several patches were replaced, together with a complete reassembly of the entire fin construction. This change in plans will retard the work several days from the date originally intended for completion.

The lift of the C-14 is estimated as being several hundred pounds in excess of the C-2, due to the fact that the envelope is approximately 10,000 cubic feet over-size. The envelope is considered by the officers in charge as having a rather poor general outline, as irregularities developed in the surface when inflated.

Tests flights are being carried on, and as soon as it is deemed practicable, the ship will be flown to Aberdeen Proving Grounds on its first cross-country flight.

Tracing the Movement of Troops

The 22nd Photo Section, stationed at Kelly Field, Texas, recently coöperated in the maneuvers held by the Second Division. A mosaic map of the area occupied by the troops of the Division was made one day when the area was occupied, and another was made the following day, after the troops had been withdrawn. Very satisfactory results were obtained, it being possible to trace the movements of the various regiments almost as well as though they had built roads to move out on, and proved to the officers of the Second Division the value of aerial photography in tracing the movements of troops. Of particular value was the proof of the ability of the K-1 camera, fitted with a K-3 filter, and using Panchromatic film, to pierce the haze so often encountered in aerial photography. The photographs were made at an altitude of 9,300 feet, through a dense haze which extended up to about 10,000 feet, and which rendered it impossible to pick out a point four miles distant with the naked eye. This point was some large, bright red building. Regardless of this disadvantage, however, the negatives obtained were clear and snappy. Captain Giffin piloted the photographic ship and Cadet Thomas made the exposure.

Towing Balls from Flying Airplanes

Adventure is introduced into drab science in the flying experiments of the National Advisory Committee for Aeronautics at Langley Field Memorial Laboratory at Langley Field, Va.

"Towing full sized wings, struts and wooden balls from a flying airplane has its ups and downs," says Thomas Carroll, test pilot for the Committee.

Renewed flights have been made to determine the comparative properties of various wind tunnels by the dragging of various sized spheres through the air at actual flight speeds. Design data has been largely based on the wind tunnel experiments in France, England, Italy, Germany and America, in which tenth or twentieth scale models have been utilized. Each of these different laboratories gives a varying figure for the same thing, and quite naturally.

By the towing of spheres through the air, the actual conditions of flight in free air are reproduced and the results when compared with the wind tunnel figures show the relative accuracy of the work of any one tunnel.

The relation between the sphere drag in a tunnel and the drag when moving through unrestricted air has not previously been measured, due to experimental difficulties. However, the comparison between wind tunnels and actual flight is very important, for the chief use of wind tunnels is to tell us what will happen in flight; so that it is quite necessary for us to know how far the tunnel results depart from the truth.

In view of this, the N. A. C. A. set its engineers to work to devise a method of testing the drag of spheres in free air. These wooden balls are from four inches to forty inches in diameter and are suspended, when being tested, by a fine wire from airplanes in flight, with instruments to measure the angle of the wire with the vertical. Knowing this angle and the weight of the sphere, it is an easy matter to calculate the drag of the sphere itself.

These spheres are not merely just plain balls, but they must be accurately spherical and their surfaces must be highly polished, for irregularity would create eddies and give erroneous values of the drag.

The airplane must be flown horizontally and at a constant speed during these tests and this requires a skilled pilot. It is also necessary to fly when the air is smooth, else the sphere will swing about like a giant pendulum and, if care is not taken, become uncontrollable. It would be mighty unpleasant to have one of these large balls swinging about at the end of a wire, thinks Mr. Carroll.

Left to right:—G. G. Albertoni, chemical engineer who will act as interpreter; Umberto Nobile, Chief Aeronautical Engineer for the Italian government; C. H. Zimmerman, aeronautical engineer.

Taken on arrival of M. Nobile at Akron, Ohio enroute to the Goodyear Tire and Rubber Company for whom he will be consulting engineer in the construction of the giant 300 ft. semi-rigid airship soon to be built by Goodyear for the United States War Department.

REVIEW of WORLD AERONAUTICS

European Air Traffic

Traffic on the Continental airways reached a record figure during the month of August. Not only did the numbers of machines flying to and from Croydon surpass any previous monthly figure but the numbers of passengers travelling by air and the weight of goods transported also exceeded the highest totals hitherto recorded.

As compared with July, when the passengers on all routes were 1591, the August travellers increased by more than 1000, the exact number using air services being 2682. The previous best monthly figure was 2,021 in August of last year.

It is satisfactory to note that the British Companies carried the largest proportion of this traffic, their share slightly exceeding 82 per cent of the whole, while the French and Dutch Companies between them received only about 18 per cent. A year ago the British Companies' proportion was just over 45 per cent, so that there is not merely an increase in numbers but also clear indications of the preference of air travellers for British operated services. The number carried by British lines was 2,203.

The weight of air borne goods also rose to 77.8 tons, an increase of several tons on the July figures which were a record. A special feature of this traffic was that there was a daily average of slightly more than one ton of newspapers from London to the Continent during the month. Nearly the whole of the outgoing newspapers were carried by British aircraft. Incoming newspaper traffic was small in proportion, but the total newspaper traffic weighing 37.4 tons formed the largest class of goods transported by air. Other goods traffic amounted to 40.4 tons of which British and French machines each took 17 tons. Dutch aircraft carried in all 6.4 tons.

The number of machines flying on the Paris, Brussels, and Rotterdam services increased to 912 from 711 in July, a figure which was itself a record. The daily average of machines was therefore over 30. British Companies operated 598 of the total while French firms' machines numbered 210 and the Dutch Company accounted for the remainder of 104. The number of departures from the London Terminal Aerodrome, Croydon was 457 and the arrivals 455.

The efficiency of British operated machines was again very high, over 95% of the flights by British aeroplanes on the London-Paris route being completed within the stipulated period of four hours while practically 90% of the flights were made in less than 3 hours.

The percentage of useful passenger accommodation and general cargo space utilised during the month on British aircraft was 48%, which is a slight increase on the proportion during July.

The approximate distance flown by aircraft during the period was 185,000 miles, of which 115,000 miles were covered by British machines. On the London-Paris route, British and French machines flew 132,000 miles, while 30,000 miles were covered between England and Belgium, and 23,000 on the London-Rotterdam route.

There were no casualties or injuries to passengers or crews during the month.

French Airships Must Have Certificates of Navigability

Airships were moved a degree further toward receiving the same treatment as warships by the publication Oct. 22 of a decree in the Official Journal dealing with their certificate of navigability.

The decree, which came into force Nov. 15, declares that the certificate of an airship remains in force only so long as it possesses a rating certificate from the Bureau Veritas, which is the French equivalent of Lloyd's, certifying that the technicians of the Veritas Bureau have found the airship in a good state of navigability.

Airship Line From Sevilla to Buenos Aires

According to articles appearing in the current press, the proposed airship line from Sevilla, Spain, to Buenos Aires, Argentina, will start operations in the not distant future. In Sevilla and Buenos Aires the installation of airdomes is about to be started. Three hangars will be built in Sevilla—two to house three Zeppelins, and the third one to shelter a dirigible of smaller size, which will cover the route from Sevilla to the Canary Islands, carry 29 passengers, and will cost 500 000 pesetas.

Of the hangars to be constructed at Sevilla, the largest will measure 300 by 90 by 50 meters, and will be the station shed. The other two will measure 300 by 50 by 50 and 150 by 50 by 50 meters, respectively. The first of these last two is to be used for repairs to ships, and the second to shelter the training ship. The regularity of the winds in the region is unusual, and for that reason it is expected that no serious difficulty will be encountered in landing and entering these sheds, which will be fixed in direction. On the other hand, in Buenos Aires the winds are more variable in direction and greater in velocity. A revolving shed is projected, measuring 280 by 50 by 50 meters, and another, fixed in direction. The first one can be turned in any direction, and this will facilitate the operation of landing. An alternative idea is to have a circular shed, measuring 350 meters in diameter, equipped with 16 doors.

Three of the four ships to be built will be of 135,000 cubic meters capacity, 250 meters long and 33.8 meters greatest diameter. The fourth will be of 30,000 meters capacity, 144 meters long and 21.1 meters in diameter. The big ships will carry nine motors of 400 h. p. each, mounted in independent cars. The ship will carry 40 passengers, besides the crew, and eleven tons of mail or freight. The economical speed will be 110 kilometers an hour, and the maximum speed 132. Two of the motors will be kept in reserve, and it is not contemplated that the other 7 will be in use all at the same time, except in case of heavy opposing winds.

The quarters for the pilots and officers of the ship, the saloon, the kitchen and the smoking room will be in the forward part. It is expected to make a trip in each direction each week. The western trip, it is calculated, will require 3 days and 16 hours, but the eastern trip 4 days and 6 hours, due to the fact that atmospheric conditions are less favorable. The cost of the trip will be 10,000 francs, and the round trip may be made in seven days. A mail service is to be included, and the postage on a letter from Sevilla to Buenos Aires will be 3 francs and 75 centimes.

The whole project is the idea of Major Herrera, and was worked out by him during the war. His studies indicate that the 10,000 kilometers can be easily traversed in a single flight.

After the preliminary studies and calculations were completed and reviewed, General Echague presented the project to the League of Nations, which gave it effusive praise. No action was taken, however, for various reasons, among them the fact that the Argentine Republic was not represented in the League. The King of Spain is deeply interested and enthusiastically in favor of the realization of this scheme.

The company has been formed, including among others the Senores Berreatua and Rementerias and as President, Senor Goicoechea, the former Minister. After further study in consideration of the project and the figures, Senor Goicoechea, with three of these experts, made the trip to Buenos Aires. There the Spanish project was received by the Argentine Republic and by Colonel Mosconi, Chief of

The New Type L-57 Albatros, equipped with 240 H.P. Rolls Royce engine.

the Aviation Service, with the greatest enthusiasm.

The total expenditures for material, pay of personnel, construction of the ships and of the sheds, etc., amount to approximately 100,000,000 pesetas. According to Senor Herrera, the ships will be of a new type. As shown by the experiments of the Zeppelin factory during the war, no danger or difficulty is apprehended from storms. For the past five years there has not been a single accident in the daily air service in Germany.

The development of this service will be a favorable impulse to the national industry. In the beginning German pilots will be employed on these ships, and the materials of construction, including that for the frame, which is an aluminum alloy, will be imported from Germany. It is expected, however, that this material will be later produced in Spain.

A Monument to a Pioneer Aviator

There was recently unveiled at Cap Blanc Nez, France, a monument erected to the memory of Hubert Latham, the famous French pioneer aviator, who will be remembered for his flying in England in the early days of aviation, and who made two attempts before M. Bleriot to fly across the English Channel. In this he failed, and when rescued from the water on the second occasion, July 27, 1909, was calmly seated on his machine smoking a cigarette. Mr. Latham was killed in French Congo in 1912 while hunting wild buffalo.

Americans will recall this nervy little airman and his famous Antoinette monoplane in which he made several exhibition flights in this country. Natives of Baltimore, Md., no doubt still remember that eventful day, November 7, 1910, when they were thrilled by his 42-minute flight over the city for the prize of $5,000 offered by the Baltimore SUN.

Aerial Route Between Italy and Egypt

On the arrival in Italy of one of the four large hangars of 2500 m. which Germany has to deliver to Italy, Mr. Gino BASTOGI proposes a great airship route, starting from Milan with stops at Rome—Tripoli—Bengasi and ending with Alexandria, Egypt.

The distance of Km. 540 from Milan to Rome would be made in 6 hours passing over the Giovi at little over 1000 meters and then over the water. This would be better than the entire air route which, although 50 Km. shorter would compel a greater altitude from the Piacentino mountains to the roman territory.

The distance of Km. 1020 between Rome and Tripoli would take about 10 or 11 hours; all maritime route, therefore the best. At present it takes 3 days from Rome to Tripoli and four days from Milan.

The distance of 680 Km. Tripoli and Bengasi could be made in seven hours, great advantage in comparison with the present means of communication, exclusively maritime and therefore five times slower than the airship.

The last lap of Km. 980 from Bengasi to Alexandria would take 10 hours; following the coast, with a short flight across the Cyrenean plateau with elevation of not more than 300 m.

The chronological advantage of the route would be reached at Alexandria, Egypt; where there are many rich Italians who come often to Italy for business or pleasure, making the trip on fast steamers which take 5 days to Rome or Milan, costing about Lire 4000 while with the proposed aerial route would take less than 2 days and would cost Lire 2500 and little more for the food.

Beside the Italians and Egyptians, everybody going to and from Europe and further than Suez Canal, will take advantage of the three days gain offered by the aerial route, as Milan is the crossway of all the fast railroads leading to France, England, Belgium, Holland and Germany.

Even the mail, all of it, or the stamped, could be carried with profit; 10 000 letters could easily find place on board, without disturbing the passenger's baggage and special merchandise.

There will be room for 30 passengers and the speed would be from 90 to 110 Km. corresponding to half of the power. The speed of 125 Km. which can be developed constitutes a remarkable margin to make up for delays or for climbing up to 10 m. per second.

A Prize for Papers on Airships

The Council of the Royal Aeronautical Society have decided to institute forthwith from the funds of the R.38 Memorial Research Fund, an annual prize for a technical paper on Airships. The regulations covering the award of this prize are given below, from which it will be seen that the date for the receipt of the names of intending competitors for the first award is December 31st, 1922, while the papers themselves must reach the Secretary on or before March 31st, 1923.

From the income of the above Fund, a sum of twenty-five guineas will be offered annually as a prize for the best paper received by the Royal Aeronautical Society, on some subject of a technical nature in the science of Aeronautics. Other things being equal, preference will be given to papers which relate to Airships.

The prize is open to international competition. The Royal Aeronautical Society retain the right to withhold the prize in any year, if it is considered that no paper is of sufficient merit to justify an award.

Intending competitors should send their names to the Secretary of the Royal Aeronautical Society, 7 Albemarle Street, London, W.I. on or before December 31st of each year, with such information in regard to the projected scope of their papers as will enable arrangements to be made for their examination. The closing date for the receipt of papers will be March 31st in each year.

Papers should in all cases be typed, and a copy should be retained by the Author, as the Society can take no responsibility for the loss of copies submitted to it.

Successful papers will become the absolute property of the Society, and will in most instances be published in the Society's Journal. In regard to unsuccessful papers, the Society retains the right of publication in its Journal, but in each case will notify the Author shortly after the award, whether it intends to exercise this right: if not, the Author will be free to publish elsewhere. A signed undertaking must accompany each paper, to the effect that the publication has not already taken place and that the Author will not communicate it elsewhere until the Society's award is published. Due acknowledgement must be made by the Author of the source of any special information.

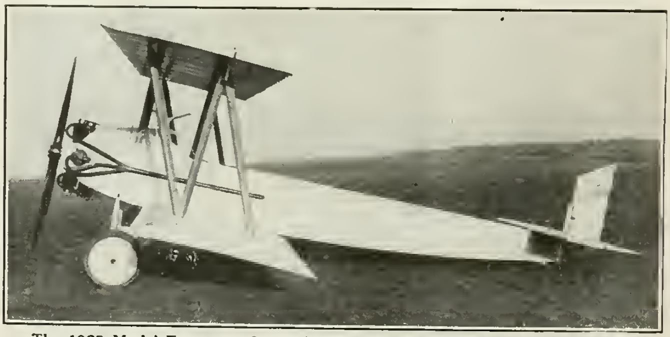
International Commission for Air Navigation

The International Commission for Air Navigation, established by the International Air Convention which governs Civil Aviation, have concluded a very successful Session in London. Sessions are held three times a year, in February, July and October, the first having taken place in Paris last July following the ratification on June 1st of the Convention signed on October 13th, 1919 in Paris.

At this Second Session the following were among the subjects discussed:—

(1.) The amendment of Article 5 of the Convention, which prohibits, except by special and temporary authorization, the aircraft of a non-contracting State from flying over the territories of contracting States, proposed by the French delegates, was accepted in principle. This proposal is that individual agreements may be drawn up between them contracting and non-contracting States, authorizing international air communication between them provided that the general regulations of the Convention are conformed to. It will now be necessary to obtain the ratification of this amendment by the various contracting States.

(2.) The system of voting on the Commission, which gives a preponderance of votes to certain Great Powers, and therefore has tended to discourage other States from becoming Parties to the Convention, was reviewed at the request of both the British and the Belgian delegations. The proposals for the removal of this difficulty was sympathetically received



The 1923 Model Farman 2-Seater Touring and Sport Plane. It is equipped with a 50-60 Anzani Air cooled motor.

by the whole Commission and will be explored by the several Governments before the next Session.

(3.) Minimum international standards for airworthiness certificates.

(4.) The medical examination of pilots and other air personnel.

(5.) A system under which aircraft registration letters and wireless call letters would be the same.

(6.) A revision of the regulations as to signals and log-books.

The Third Session will be held in Brussels towards the end of next February on the invitation of the Belgian Government.

Between the Sessions the Sub-Commissions Operational, Wireless, Meteorological, Medical, Legal, Maps continue their activities.

Japan Institutes Aerial Mails

Flights in Japan's first air mail service, to run between Tokio and Osaka, a distance of 450 miles, were attended with fair success Nov. 3. The weather was perfect. One air postman flew from Osaka to Tokio in three hours. Another made the trip from Tokio to Osaka in four hours.

Commercial Aviation in South Africa

The South African Airways Co. (Ltd.), whose capital of £200,000 is being subscribed in England, has been organized to inaugurate commercial aviation in South Africa. Government assistance in the form of free training of pilots, free landing grounds, hangars and aerodromes when available, repairs and supplies at cost, as well as co-operation with the postoffice in the transmittal of letters and parcel post, is anticipated if the company attains a financial status satisfactory to the Government.

It is intended at first to concentrate on the main route from Cape Town to Johannesburg, and the company hopes to commence operation by the end of 1922. This route will be worked in three relays with 12 machines having Rolls-Royce engines. After establishing the main route, it is planned to extend the service from Johannesburg to Durban, a flight of three hours. It is proposed to run a Cape Town-Johannesburg-Pretoria service once daily in each direction, and the Johannesburg-Durban service twice daily each way, except Sundays and Holidays.

Obstacles to the success of this project lie in the great distances and sparseness of population and in the high operating costs.—Commerce Reports.

Non-Stop Berlin-Moscow Flight

Joachim Styllbrock, a German airman, recently accomplished a notable feat in aviation when he made a non-stop flight from Moscow to Berlin, a distance of 1,115 miles, in 18 hours. He piloted a Fokker R-4, fitted with a Rolls-Royce engine, and had as his passengers the Russian representatives in Berlin, M. Krestinski, and two government officials. The machine traveled over the towns of Vyasma, Smolensk, Vitebsk, Polotsk, Dunaberg, Kovno, Konigsberg, and thence to Berlin.

French Government Cooperation

Vice Consul John F. Simmons, Paris, in a recent issue of Commerce Reports (U. S. Dept. of Commerce) states that the French Government renders very practical assistance to airplane manufacturers in their efforts to develop new types of aircraft. The "Service Technique" outlines the type of craft desired, and any manufacturer may submit a design, according to the conditions specified. If the manufacturer's type is selected, the firm receives a trial order; and if the craft is successful the firm receives an additional order with the assurance that no manufacturer will produce its type of craft without paying the firm a royalty. Thus each manufacturer is induced to produce original designs, as he knows that quantity orders will be given to his firm and not to a rival who, not having had to bear the cost of experimenting, might be able to underbid him.

The "Service Technique" passes on all models, the tests being made at one of the best equipped laboratories in the world, located at Issy-les-Moulineaux. These laboratories are all new and the largest wind tunnel which has yet been constructed will soon be put into operation at Issy. Aviation is also encouraged by a large number of cash prizes offered by the Government, the aero clubs, and various individuals for flying feats.

Announcement has been made by the French Aeronautical Chamber of Commerce to the effect that the Aero Show will be held at the Grand Palais, Paris, from December 15, 1922 to January 2, 1923.

New Scandinavian Record

A new altitude record for Scandinavia (23,293 feet) was recently established by Lieut. Gottenburg of the Norweigan Army Air Service, accompanied by a passenger. Both were provided with oxygen apparatus. The former record was 16,732 feet.

Airships Five Times Bigger Than Zeppelins

Engineering data now available indicates that the next commercial airship will be monstrous in size, even to seven or eight times the size of present-day airships of the German type. Practice in the building of giant airships has shown that there is continued advantage in increasing the cubic capacity of the gas containers, which means a smaller volume of gas per passenger carried, a smaller weight of fuel per passenger, which means a lower rate of transport.

Recall the Schutte-Lanz of practically 2,000,000 cubic feet capacity, 650 feet in length by 75 feet in diameter, carrying a useful load of 39 tons, driven by 1200 h. p. at a speed of 64 miles an hour.

The useful load is 58 per cent of the total. The useful load of the Junker airplane, probably one of the most efficient in this country, is 36 per cent of the total. There is no longer any argument as to the sphere of the airship for economical long-distance transportation.

It is difficult to conceive the gigantic proportions of an up-to-date air liner of 10 000,000 cubic feet capacity.

This advantage in the continued increase in cubic contents persists as far as engineers have figured, and they have extended their calculations to ships of over 14,000,000 cubic feet of gas capacity, where nearly 3 passengers can be carried for every 39,000 feet of gas.

However, Colonel Crocco, one of the greatest authorities in airship design, a pioneer experimentor in Italian aeronautics, states that there is "an optimum value of the ratio between the useful load and the total load at about 270,000 cubic metres (9,554,490 cu. ft.), and that practically the increase of cubature beyond this limit and even up to it, hardly compensates for the greater commercial risk incurred by the concentration of tonnage."

In other words, it would be a better business proposition to operate two ships of 7,000,000 cubic feet than one of fourteen.

The General Air Service, which proposes to operate three ships between New York and Chicago, figures on craft of the moderate size of 4,000,000 cubic feet, which is twice the size of the largest airship built to date.

For a very complete bibliography of books on airships, see Army Air Service Information Circular (Aviation) No. 21, "Aeronautical Book and Magazine List," available by reference only.

Are German Aircraft Engines More Efficient?

Allied aircraft pilots who were pitted against the enemy in the World War, as well as automobile engineers and everyone looking to the economization of air travel, are interested in the test of the 185 h. p. B.M.W. and the 300 h.p. Maybach engines. These were made in the altitude chamber of the U. S. Bureau of Standards where conditions of temperature and pressure can be so controlled as to stimulate those of any desired altitude. Both engines exhibited excellent full-load efficiencies.

The economy of the B. M. W. was found "superior to most engines tested thus far, even at a density corresponding to an altitude of 25,000 feet. Its low fuel consumption is the outstanding feature of merit."

Economy of air transportation in dollars and cents of actual carrying costs is now of absorbing interest in the consideration of possible air routes. There is, too, the economy in flying at high altitudes, made possible by the supercharger and the adjustable propeller. Every ounce saved in fuel means an increase in the useful "pay load."

While the efficiency of the engine is not the whole story, it is of interest to make a comparison between the best known American-built machine, the DH4 with Liberty engine—not motor—and the German-built all-metal Junker with the B. M. W. which has been flying in America.

Characteristics

	DH4	Junker SL
No. occupants	2	4
Weight empty, lbs.	2391	2317
Useful load, inc. fuel and oil, lbs.	1191	1288
Weight loaded, lbs.	3582	3605
H.P. about 1400 r.p.m	400	243
Useful load per h.p., lbs.	2.971	5.30
Ground speed at about 1400 r.p.m., m.p.h.	120	111
Endurance, one charge, hours	2.6	5.30

To arrive at a measure of efficiency, in a popular way, one can take the fraction 111 over 120 (speed comparison) and multiply it by the fraction 5.30 over 2.97 (load per h.p. comparison) and find that the DH4 is but 63 per cent as efficient as the Junker.

True, the DH was not built as a passenger-carrier but as a certain type of war machine. But the fact remains that we have not in this country in actual service a machine that will outstrip the B. M. W. in economy of performance.

With the present great interest in the possibility of passenger air lines and their expected stimulation through the proposed establishment of a federal bureau of civil aeronautics, the question of economy in actual cost per ton-mile is vital.

Exhaustive information on the performance of the Maybach and B. M. W. engines may be had in N. A. C. A. Reports 134 and 135.

"Technical Notes" of the N. A. C. A.

THERE has been printed in the November issue of *Aerial Age* a complete list of the printed **Reports of** the National Advisory Committee for Aeronautics to that date. Following is a list of the "Technical Notes" of the Committee. These are prepared in mimeographed form, frequently with photostated illustrations, but owing to limitations of funds and the processes of publication, these are not always available in sufficiently large quantities to meet any very great demand. However, they may be found in a number of libraries or may be obtained on loan from the Committee, at the New Navy Building, Washington, D. C.

These and other lists of Government documents are being printed by *Aerial Age* with the idea of making available either by possession or loan all possible information on aeronautics.

New reports and notes of the Government and new books, of course, will be noticed from time to time in the pages of this journal.

No.
1 Notes on Longitudinal Stability and Balance, by Edward P. Warner, N.A.C.A.
2 Airplane Performance as Influenced by the Use of a Supercharged Engine, by George de Bothezat, N.A.C.A.
3 Notes on the Theory of the Accelerometer, by Edward P. Warner, N.A.C.A.
4 The Problem of the Helicopter, by Edward P. Warner, N.A.C.A.
5 Relation of Rib Spacing to Stress in Wing Planes, by A. F. Zahm, Bureau C & R, Navy Dept.
6 Static Testing and Proposed Standard Specifications, by Edward P. Warner, N.A.C.A.
7 Notes on the Design of Supercharged and Over-Dimensioned Aircraft Engines, by Otto Schwager. Translated from Technische Berichte, Vol. III, Sec. 5, by George de Bothezat, N.A.C.A.
8 Duralumin, by E. Unger and E. Schmidt. Translated from Technische Berichte, Vol. III, Sec. 5, by Starr Truscott, Bureau C & R, Navy Dept.
9 Theory of Lifting Surfaces. Part I, by L. Prandtl, 1918. Translated from the German and abstracted by W. Margoulis, N.A.C.A.
10 Theory of Lifting Surfaces. Part II, by L. Prandtl, 1919. Translated from the German and abstracted by W. Margoulis, N.A.C.A.
11 The Problem of the Turbo-Compressor, by Rene Devillers. Extract from "The Internal Combustion Engine." Translated from the French by Paris Office, N.A.C.A.
12 Recent Efforts and Experiments in the Construction of Aviation engines, by Otto Schwager. Translated from the Technische Berichte, Vol. III, No. 5, by Paris Office, N. A. C. A.
13 Soaring Flight in Guinea, by P. Idrac. Translated from the French, by D. L. Bacon, N.A.C.A.
14 Increase in Maximum Pressures Produced by Preignition in Internal Combustion Engines, by S. W. Sparrow, Bureau of Standards.
15 Tests of the Daimler D-IVa Engine at a High Altitude Test Bench, by W. G. Noack. Translated from Technische Berichte, Vol. III, Sec. 1, by Paris Office, N.A.C.A.
16 Experience with Geared Propeller Drives for Aviation Engines, by K. Kutzbach. Translated from Technische Berichte, Vol. III, Sec. 3, by Starr Truscott, Bureau C & R, Navy Dept.
17 Italian and French Experiments on Wind Tunnels, by William Knight, Paris Office, N.A.C.A.
18 The Dynamometer Hub, by W. Stieber. Translated from Technische Berichte, Vol. III, Sec. 6, by Technical Staff, N.A.C.A.
19 The Steadiness Factor in Engine Sets, by W. Margoulis, Paris Office, N.A.C.A.
20 Notes on Specifications for French Airplane Competitions, by W. Margoulis. Translated from French, by Paris Office, N.A.C.A.
21 Drag or Negative Traction of Geared-Down Supporting Propellers in the Downward Vertical Glide of a Helicopter, by A. Toussaint. Resume translated from the French, by Paris Office, N.A.C.A.
22 The Photographic Recording of Small Motions, by F. H. Norton, N.A.C.A.
23 Horizontal Buoyancy in Wind Tunnels, by A. F. Zahm, Bureau C & R, Navy Dept.
24 Development of the Inflow Theory of the Propeller, by A. Betz. Resume translated from the German, by Paris Office, N.A.C.A.
25 Center of Pressure Coefficients for Aero foils at High Speeds; by Walter S. Diehl, Bureau of Aeronautics, Navy Department, Washington, D. C.
26 A Variable Speed Fan Dynamometer, by Karl D. Woods, Bureau of Standards.
27 Instrument for Measuring Engine Clearance Volumes, by S. W. Sparrow, Bureau of Standards.
28 Loads and Calculations of Army Airplanes, by Stelmachowski Translated from Technische Berichte, Vol. III, No. 6, by Office of Naval Intelligence, U. S. N.
29 Progress made in the Construction of Giant Airplanes in Germany during the War, by A. Baumann. Resume translated from the German by Paris Office, N.A.C.A.
30 Design of Recording Wind Tunnel Balances, by F. H. Norton, N.A.C.A.
31 Crippling Strength on Axially Loaded Rods, by Fr. Natalis. Translated from Technische Berichte, Vol. III, No. 6, by Prof. Pawlowski, University of Michigan.
32 Causes of Cracking of Ignition Cable, by F. B. Silsbee, Bureau of Standards.
33 The Effect of the Nature of Surfaces on Resistance, as Tested in Struts, by Dr. Ing. C. Wieselsberger. Translated from Zeitschrift für F & M, Feb. 28, 1920, by Paris Office N.A.C.A.
34 The 300 HP Aviation Engine, by Dr. A. Heller. Translated from Zeitschrift des Vereines Deutscher Ingenieure, Paris Office, N.A.C.A.
35 The Optical Wing Aligning Device of the Langley Field Tunnel, by F. H. Norton, N.A.C.A.
36 N.A.C.A. Langley Field Wind Tunnel Apparatus. The Tilting Manometer, by F. H. Norton, N.A.C.A.
37 The Determination of the Effective Resistance of a Spindle Supporting a Model Aerofoil, by W. E. Davidson and D. L. Bacon, N.A.C.A.
38 Measurements of Rudder Moments on an Airplane During Flight, by Ing. V. Heidelberg. Translated from Zeitschrift für F & M, Vols. 21 and 22, by Paris Office, N.A.C.A.
39 High Thermal Efficiency in Airplane Service, by S. W. Sparrow, Bureau of Standards.
40 Effect of the Reversal of Air Flow upon the Discharge Coefficient of Durley Orifices, by Marsden Ware, N.A.C.A.
41 Influence of Span and Load per Square Meter on the Air Forces of the Supporting Surfaces, by A. Betz. Translated from Technische Berichte, Vol. I, Sec. 4, by Lt. Diehl, Bureau C & R, Navy Dept.
42 The Determination of Downwash, by Lt. Walter S. Diehl, Bureau C & R, Navy Dept.
43 Note on the Resistance of Polished Cylinders (and Cylindrical Wires) with Generatrices Perpendicular to the Air-stream, by A. Toussaint. Translated from the French by Paris Office, N.A.C.A.
44 On the Resistance of Spheres and Ellipsoids in Wind Tunnels, by D. P. Riabouchinsky. Translated from Bulletin of the Aerodynamical Institute of Koutchino, by Paris Office, N.A.C.A.
45 Extract from a Report on the Resistance of Spheres of Small Diameter in an Airstream of High Velocity, by Capt. Toussaint and Lt. Hayer, Translated from the French by Paris Office, N.A.C.A.
46 Theory of the Ideal Windmill, by Wilhelm Hoff. Translated from the German by Paris Office, N.A.C.A.
47 Recent European Developments in Helicopters, prepared by Paris Office, N.A.C.A.
48 Airplane Superchargers, by W. G. Noack. Translated from Zeitschrift des Vereines Deutscher Ingenieure, 1919, page 995, by Office of Naval Intelligence, Navy Dept.
49 On the Resistance of the Air at High Speeds and on the Automatic Rotation of Projectiles, by D. Riabouchinsky. Translated from the French by Paris Office, N.A.C.A.
50 The Gordon Bennett Airplane Cup, 1920, by W. Margoulis, N.A.C.A.
51 Airplane Balance, by L. Huguet. Translated from "La Vie Technique and Industrielle," May, June, July, 1920 by Paris Office, N.A.C.A.
52 A New Method of Testing Models in Wind Tunnels, by W. Margoulis, N.A.C.A.
53 Similitude Tests on Wing Sections, by H. Kumbruch. Translated from the German, by D. L. Bacon, N.A.C.A.
54 The Factors that Determine the Minimum Speed of an Airplane, by F. H. Norton, N.A.C.A.
55 Airplane Crashes; Engine Trouble. A Possible Explanation, by S. W. Sparrow, Bureau of Standards.
56 The Development of German Army Airplanes During the War, by Wilhelm Hoff. Translated from Zeitschrift des Vereines Deutscher Ingenieure, 1920, P.493, by Office of Naval Intelligence, Navy Dept.
57 The Caproni Seaplane, by Max Munk, N.A.C.A.
58 Absolute Coefficients and the Graphical Representation of Aerofoil Characteristics, by Max Munk, N.A.C.A.
59 The Dynamometer Hub for Testing

Propellers and Engines During Flight by O. Enoch. Translated from Zeitschrift für F & M, Vol. X, No. 19, by Paris office, N.A.C.A.

60 On a New Type of Wind Tunnel, by Max Munk, N.A.C.A.

61 Performance of a Vane-Driven Gear Pump, by R. H. Heald, Bureau of Standards.

62 The Problem of Fuel for Aviation Engines. Lecture given by Prof. Kutzbach, of Dresden, Scientific Collaborator of the Adlershof Aeronautical Laboratory. Translated by Paris Office, N.A.C.A. Edited by W. S. James, Bureau of Standards.

63 The Employment of Airships for the Transport of Passengers, by Umberto Nobile. Translated from Giornale dei Genio Civile, Anno LIX, 1921, by Paris Office N.A.C.A.

64 N.A.C.A. Recording Air Speed Meter, by F. H. Norton, N.A.C.A.

65 Langley Field Wind Tunnel Apparatus, by D. L. Bacon, N.A.C.A.

66 Göttingen Wind Tunnel for Testing Aircraft Models, by L. Prandtl. Translated from Berichte und Abhandulungen der WGL, Sept., 1920, by N.A.C.A.

67 Ground Influence on Aerofoils, by A. E. Raymond, Massachusetts Institute of Technology.

68 The Hydrodynamics of Eddies, by A. Betz. Translated from Zeitschrift für F & M, July 15, 1921, by N.A.C.A.

69 An Investigation on the Effect of Raked Wing Tips, by F. H. Norton, N.A.C.A.

70 The Effect of Staggering a Biplane, by F. H. Norton, N.A.C.A.

71 Experiments with Slotted Wings. Three articles translated from Zeitschrift für F & M, July 30, 1921, by N.A.C.A.

72 Ameroid Investigations in Germany. Abstract from the German by M. D. Hersey, Massachusetts Institute of Technology.

73 The Choice of Wing Sections for Airplanes, by Edward P. Warner, Secretary, Committee on Aerodynamics, N.A.C.A.

74 Mutual Influence of Aerofoil and Propeller, by L. Prandtl. Translated from Ergebmsse der Aerodynamischen Versuchsanstalt zn Göttingen, by N.A.C.A.

75 Effects of Varying Relative Vertical Position of Wing and Fuselage, by L. Prandtl. Translated from Ergebmsse der Aerodynamischen Versuchsanstalt zn Göttingen, by N.A.C.A.

76 A Mechanical Device for Illustrating Airplane Stability, by F. H. Norton.

77 A Preliminary Investigation of a New Method for Testing Aerofoils in Free Flight, by F. H. Norton.

78 Impact Tests for Woods, by Bureau of Standards.

79 Effect of Aerofoil Aspect Ratio on the Slope of the Lift Curve, by Walter S. Diehl, Bureau of Aeronautics, Navy Department.

80 The Dead Weight of the Airship and the Number of Passengers that can be Carried, by Col. Crocco. Translated from Rendiconti dell 'Istituto Sperimentale Aeronautico, September, 1920, by Paris Office, N.A.C.A.

81 Langley Field Wind Tunnel Apparatus. Pt. I, Regulators for Speed of Wind Tunnel Drive Motor. Pt. II, A Vernier Manometer with Adjustable Sensitivity, by D. L. Bacon.

82 Notes on the Construction and Testing of Model Airplanes, by Walter S. Diehl, Bureau of Aeronautics, Navy Department.

83 Theory of the Propeller, by A. Betz. Translated from the German by the N.A.C.A.

84 New Data on the Laws of Fluid Resistance, by C. Wieselsberger. Translated from the German by N.A.C.A.

85 Air-Force and- Three Moments for F-5-L Flying Boat, by Aeronautics Staff, Construction Department, Navy Yard, Washington, D. C.

86 Surface Area Coefficients for Airship Envelopes, by Walter S. Diehl, Bureau of Aeronautics, Washington D. C.

87 Hydrostatic Test of an Airship Model, by Aeronautics Staff. Construction Department, Navy Yard, Washington, D. C.

*88 Report of Test of Oil Scraper Piston Ring and Piston Fitted with Oil Drain Holes, by Aeronautical Engineering Laboratory, Navy Yard, Washington, D. C.

89 The Choice of the Speed of an Airship, by Max M. Munk, N.A.C.A.

90 Sylphon Diagrams. Methods for Predicting their Performance and Purposes of Instrument Design, by H. N. Eaton and G. H. Keulegan, Bureau of Standards.

91 Notes on Propeller Design—I: The Energy Losses of the Propeller, by Max M. Munk, N.A.C.A.

92 Full-Scale Determination of the Lift and Drag of a Seaplane, by Max M. Munk, N.A.C.A.

93 The Background of Detonation, by S. W. Sparrow, Bureau of Standards.

94 Notes on Propeller Design—II: The Best Distribution of Thrust over a Propeller Blade, by Max M. Munk, N.A.C.A.

95 Notes on Propeller Design—III: The Aerodynamical Equations of the Propeller Blade Elements, by Max M. Munk, N.A.C.A.

96 Notes on Propeller Design—IV: General Proceedings in Design, by Max M. Munk, N.A.C.A.

97 N.A.C.A. Control Position Recorder, by F. H. Norton, L.M.A.L.

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98 Notes on the Design of Latticed Columns Subject to Lateral Loads. By Charles J. McCarthy, Bureau of Aeronautics, Navy Dept.

99 Notes on the Standard Atmosphere. By Walter S. Diehl, Bureau of Aeronautics, Navy Dept.

100 Theory of the Slotted Wing. Lecture by A. Betz. Translated from "Berichte und Abhandlungen der Wissenschaftlichen Gesellschaft für Luftfahrt," No. 6, 1922 by N.A.C.A.

101 Comparing Maximum Pressures in Internal Combustion Engines. By S. W. Sparrow and Stephen M. Lee, Bureau of Standards.

102 Skin Frictional Resistance ot Plane Surfaces in Air. Abstract of Recent German Tests, with Notes. By Walter S. Diehl, Bureau of Aeronautics, Navy Department.

103 Simple Formula for Estimating Airplane Ceilings. By Walter S. Diehl, Bureau of Aeronautics, Navy Dept.

104 Notes on Aerodynamic Forces—I. Rectilinear Motion. By Max M. Munk, N.A.C.A.

105 Notes on Aerodynamic Forces—II. Curvilinear Motion. By Max M. Munk, N.A.C.A.

106 Notes on Aerodynamic Forces—III. The Aerodynamic Forces on Airships. By Max M. Munk. N.A.C.A.

107 Structural Safety during Curved Flight. By A. Rohrbach. Translated from the German by N.A.C.A.

108 The use of Multiplied pressures for automatic altitude adjustments. By Stanwood W. Sparrow, Bureau of Standards.

109 The Twisted Wing with Elliptic Plan Form. By Max M. Munk N.A.C.A.

110 The effect on rudder control of slip stream, body, and ground interference. By H. I. Hoot and D. L. Bacon, L.M.A.L.

(Concluded from page 602)

the afternoon several of the planes held a thirty mile race. Mr. and Mrs. T. Ellwood Allison entertained the army and navy officers and the officials of the Aero Club at a luncheon at their home near the field.

Rear Admiral L. M. Nulton Commandant of the Philadelphia who attended with his staff also made an address.

W. H. Sheahan,
1st Vice President.

(Concluded from page 600)

compartments for the occupants, filled with fresh air of sea level density and there will be noticed no more discomforts than those of the every day Pullman while the advantages of air travel are startling. No click of the wheels over rail joints, speeds with trade winds of 200 or more miles an hour, no noise but the rush of air, no changing, panorama of Brobdingnagian proportions spreading out below.

ELEMENTARY AERONAUTICS and MODEL NOTES

American Gliding Contests

IN ANSWER to an invitation extended by the Chamber of Commerce of Daytona, Florida, to the Aero Science Club of America, the first gliding and soaring flight competition in motorless airplanes in the United States will be held at the Ormond-Daytona Beach during next January. "The Aero Science Club of America has accepted," said Stanley Yale Beach, its secretary, to-day, "and has forwarded the invitation to the Aero Club of America and the National Aeronautic Association. The Aero Science Club will be glad to conduct the meet and hopes for an unequalled participation. We hope to make some new world records in gliding flight. The contest will be open to everybody. Motorless flying is true flying and nothing could be more effective in stimulating interest in aviation."

In the invitation from the Daytona Chamber of Commerce received yesterday it was stated that a thousand dollar trophy had been donated for the first American contest. It is hoped to add substantially to this inducement by other trophies and cash prizes. The National Aeronautic Association has expressed its interest in the matter and has given its assurance of cooperation.

The invitation was extended by the Daytona Chamber of Commerce after consideration of a report on the suitability of the Ormond-Daytona Beach for the proposed contest.

"In considering the enterprising offer of the Daytona Chamber of Commerce," said Mr. Beach, "the Aero Science Club of America took into consideration the fact that it would be necessary to wait until next summer if a meet were to be held near the great centers of population in the North. Such a delay would be deplorable in the face of the encouragement given to air flight in Europe. The Aero Science Club will urge the heartiest participation by all the Army and Navy fliers, airplane manufacturers, technical schools, independent fliers and its own members."

Although the Ormond-Daytona Beach has no hills such as were taken advantage of during the contest in Germany, sand dunes offer the finest place of all from which to glide, as was proven by the fact that all the early experimenters here, such as Octave Chaute, Avery, Herring and the Wright Brothers used them. Orville Wright was one of the first men to develop the art of gliding, although he has not flown a glider since he soared over a sand dune at Kitty Hawk for ten minutes in 1911 in a fifty-seven mile-an-hour gale.

As long as every one flies under the same conditions, it does not matter whether the starting point is high or not. To hold a competition it is only necessary to have a suitable spot. Without doubt, Ormond-Daytona Beach will be a first rate place to hold a contest for the reason that a strong breeze from the sea generally prevails in which some of the machines would be able to make true soaring flights.

In the event there is no breeze, trials can be made by towing by autos on the beach, each glider being towed a certain distance and at a given speed. The same should be done on the Indian River for the sea planes, or off shore when the sea is smooth for such craft as will stand the waves.

Long soaring flights can be made on the coast as well as inland. The flight of Capt. E. P. Raynham, an English aviator, of an hour and fifty-three minutes on October 17th, the second day of the London Daily Mail contest, was made with a simple monoplane of his own construction. Captain Raynham came to the meet with little expectations. He had hoped to remain in the air for three minutes. He remained for almost two hours. So little did he expect to do any soaring that his controls were so inconveniently arranged that by the end of the flight he was quite exhausted from holding them.

It is possible to soar over the water in one of these gliders as well as over the land, as shown by the recent experiments of Glenn H. Curtiss the inventor of the flying boat. There are many who are eager to compete in a glider contest, and at Ormond-Daytona Beach they will have their chance.

Model "D" Orenco

Following is a description of the Model "D" Orenco built by a student of the Shenandoah Valley Academy, Winchester, Va.

Dimensions

Span upper	30″
Span lower	27½″
Gap	44½″
Chord	55″
Length o.a.	21½″
Height	8¼″
Propeller	9″ dia. x 8½″ pitch

Wings

The upper wing is built as one unit, the spars being continuous throughout the length of the wing. This plane is built up of 19 balsa ribs, in which holes were cut for the spars which were inserted, and the ribs spaced 1½″ apart thereon. The front spar is centered 13/16″ from the leading edge, and the rear spar is 2½″ from it. The front spar is 3/16″ x 5/32″, while the rear spar is slightly smaller, owing to the narrowness of the ribs at that point.

Ailerons are on the upper plane only, and these measure ⅞″ x 1¼″. The spars at the ailerons are beveled, providing a much neater hinge.

The lower planes are built up of 8 ribs each, and both wings have an edging of reed slightly less than 3/32″ in diameter.

All of the struts are streamlined, and the fastenings for the wires are of aluminum, but a couple of turns of No. 32 gauge steel wire about the spar at each connection will be found much stronger and efficient, although it does not look as much like the real thing.

The covering is of very fine silk, doped and varnished. Wing section used is U. S. A. No. 15.

Fuselage

This is constructed in the usual way. At the rear, a permanent fastening is made of the tail-skid and a rear post for the fin, thereby eliminating wires from the empennage.

The pilot's head-rest is of aluminum, as is the cowl containing the cockpit forward to the motor. Here balsa wood has been used, cut to the form shown in the photographs, by which the outline of the dummy Wright motor could be most easily adhered to. Small paper tubes are used to simulate exhaust pipes.

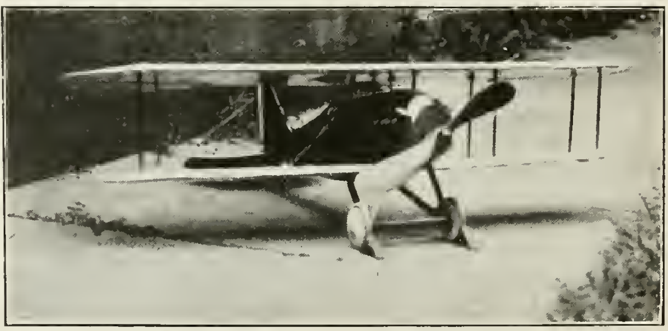
The radiator is cut from soft pine, and may be taken out. It is attached to the motor-stick, whose only other connection with the body is made by a piece of #34 wire about the center of the upper cross-piece at the back of the cockpit. Ten strands of 1/16″ square rubber proved to be of enough power to fly the model R. O. G.

A piece of aluminum forms the under cowl, extending from the radiator as far back as the entering edge of the lower wing.

A small cap of balsa was placed on the propeller hub recently, which is not included in the length of the fuselage as given above.

Landing Gear

This is made of spruce, and is ½″ x ⅛″ except about the axle, where the joint was made at the vertex of each "V", and the



Model "D" Orenco built by an Aerial Age reader proper curve required a greater width. A rounded oblong hole 1/3" x ½" is provided for the floating axle, which is held in position by small rubber bands. Two cross-braces are used, also streamlining the axle.

The wheels are 2¼", covered with fabric and doped, being perfectly flat on the inside, but the fabric raised ⅜" at the hub on the outside.

The tail-skid fairing is balsa, while the hinged skid itself is of hard-wood with rubber shock-absorber.

Empennage

The fin is fastened to a post ⅛" square which is attached permanently to the fuselage, and is made up of balsa wood ⅛" thick and is covered and doped.

The rudder is made up in the usual way, with an edging of 3/32" reed, except that the upper rib which forms the lower edge of the balanced portion is built of two pieces of thin spruce ⅛" x 1/32", one of which goes on either side of the ⅛" round bar forming the hinge of the rudder.

The stabilizer has only the forward spar continuous and running through the fuselage. Its ribs are of ⅛" x 1/32", and pass on both sides of the spar, meeting at the entering and trailing edge, giving it a double-cambered surface, as in a portion of the rudder. It is adjustable, and has 3/16" play at the entering edge, as the spar is the only piece which enters the body.

The elevator, being single acts as a good brace for the rear of the stabilizer. It is easily built of one ⅛" round bar at the front, and edged with 3/32" reed, held in place by four ⅛" square balsa strips.

General

The entire fuselage, fin, and balanced portion of the rudder are given a coat of olive-drab enamel. The machine has the regulation U. S. Army insignia.

All doped surfaces, stabilizer, elevator, wings, and wheels, and all exposed wood, i. e., struts, landing-gear and propeller, are Valspared. Recently, however, the wings, elevator and stabilizer were enamelled cream.

The performance last summer proved far better than the builder had expected; it won first place among other scale models of the C. M. A. C. in Washington. It seemed balanced almost perfectly without moving the wings in the slightest, or changing the position of any of its surfaces, which is somewhat unusual for a scale model in which all dimensions of its prototype have been strictly adhered to. One great help is the solid block of balsa in the nose above the top longerons.

In flying against a 6 or 7 mile wind, its tail rises almost immediately, and it is off the ground before it has run 15 feet. It then rises at a good angle, and when the power gives out, lands easily.

Gliding and Soaring Flight

The gliding and soaring flights occupying the attention of Europe and America are the modern experimenters best means of bird-flight study. Gliding was practiced in the early days of aeronautics as the first step toward flying. When the motored glider or aeroplane became a reality, gliding was for a time quite abandoned as merely an elementary principle which needed no further development. Now it may seem odd for even professional pilots again taking up the sport of gliding and its later development, soaring, yet there are very good reasons for the return, as we shall see.

Perhaps the greatest benefit to be derived by the accomplishment of true soaring flight is economy of power. Now altho man soon learned to fly through the air faster than any bird, the fact remains that man requires considerably more power in proportion to his accomplishment in speed. Of course the original problem was to fly at no matter what cost. Once the pioneers of aviation demonstrated that flight was possible, the tendency was to increase the speed of flight. It was found that for motored flight that safety lies in speed, up to a certain point. Therefore we have had speed development, best evidenced in the army Curtiss Racer which flies at more than four miles a minute.

It is not supposed that the glider, or soaring "sail-plane", will supplant the modern aeroplane any more than yachting would be expected to do away with the motor boat. But each has a purpose to serve.

To return to the early use of the glider—man learned to balance himself in the air, found out about air currents and the effects of the atmosphere on his craft and tested the value of various bird-like wing structures. When the powered glider came into existence, attention was directed principally toward perfecting the engines and the controlling mechanisms. Much research into the fundamental principles underlying flight was set aside in many instances because of the pressing demands of physical development. This is clearly brought out in the fact that from the time of the first flight, aircraft development made considerably greater progress in the same period of time than the automobile industry.

We are approaching the limit in speed for aircraft of the type we are familiar with today. Still there remains the economy factor, and it is through our gliding and soaring experiments that we must look for the solution of the low powered air vehicle which will rival the automobile in economy, ease of maintenance and operation.

In order to appreciate the problems and difficulties confronting the designer of motorless aircraft, it is well to touch upon some of the distinctions, principles, laws governing the various types of craft under consideration.

The Glider

The glider is the simplest form of aircraft. It comprises a surface which retards the downward movement caused by gravity, resolving it into a forward movement. In a glider, the path of flight is continually downward and forward due to gravity and pressure of air on the wings respectively. The most efficient glider is that in which the rate of descent is slowest. The gliding angle, therefore, is the angle of descent, and the greater this angle, the better the glider, for it means that greater ground may be covered in descending from a given altitude.

Birds glide at the rate of about 12 to 1; that is, for each foot of elevation, the bird skims forward 12 feet, with no power other than the action of gravity. The modern aeroplane, when the motor is stopped becomes a natural gliding machine, and while tending always earthward it may travel forward in straight or circling paths at a rate of 8 feet for each foot of elevation. In other words, it moves forward eight times as fast as it does downward, assuming an angle of descent in that particular relation. Therefore a flat gliding path is desirable in any machine as it makes possible a wider choice of landing territory.

A glider, or aeroplane in which the motor is stopped, must descend at a rate of speed not less than that determined by its lift in relation to its weight, although for making a landing at predetermined places, within gliding distance the control surfaces permit of increasing this angle at will. In this manner, the angle of descent may be said to be variable, altho having a definite minimum angle.

With this in mind, it is easily seen how the gliding angle effects the range of action of an aeroplane in coming to the earth—a plane with a gliding angle of only 6 to one, beginning a glide at 100 feet, has available to itself a circular plot of ground 1200 feet in diameter, that is, 600 feet in radius, in which to affect a landing. On the other hand, a machine capable of gliding at an angle of 8 to one has a wider choice in selecting its landing place, as it may glide to any point within a 1600 foot circle below. Taking this 100 foot altitude for a comparison of two ships as this, we find that the plane which glides at 8 to one actually has ——— square feet more of ground in which to land. The amount of territory included by the flat-angle glider is proportionately greater from higher altitudes.

In gliding experiments, the glider is launched from an altitude, preferably a sloping hillside. Gravity carries it downward as it glides forward. Balance is maintained by the operator shifting the weight of his body slightly from side to side or fore and aft. In the more proficient gliders, controls similar to the conventional aeroplane are used.

A glider, then, may travel not further than a definitely fixed distance which is determined by its weight and altitude. Its field of operation is therefore limited.

There is another form of glider which has recently come to public notice. This is the "towed" glider—one which is towed through the air by means of a powered vehicle. Glenn H. Curtiss has designed a glider of this type. It has been successfully towed by a high speed motor boat and on another test was towed by a flying boat. The tests showed that "air-trailers" may become an important factor in future development of the glider.

Where a glider is towed through the air, the force which pulls the machine forward takes the place of the power supplied by gravity, and inasmuch as the pulling force is forward instead of downward (as in the case of gravity) greater lift is obtainable, and therefore horizontal and even lifting flight may be accomplished as long as the pulling force continues. As soon as the towing wire is released, and the forward pull discontinues, the "air-trailer" becomes a true glider and descends slowly under the influence of gravity gliders or "air-trailers" may be developed into soaring planes or "sail-planes", the characteristics of which are exceedingly more complex.

The "Soaring Plane"

The soaring plane may travel in all directions, with or against the wind. It may rise and dip as various air currents are encountered. Altho it is acted upon by gravity, the peculiar forces utilized by its wings has greater effect than gravity, thereby making lifting possible.

All concurring air flows around a wing, (as the wings of a soaring bird) is not known, but there are some basic laws and phenomenon at the disposal of the sailplane designer. Tests have shown the paths followed by air passing around a wing surface. Wings of differing contours, direct the air flow in different ways, some in such a way that they cause more lift than others.

The lifting effect is produced by the distribution of air flow over the wing. The top side of a wing is arched, with its highest point near the front. Air passing over the wing (or the wing passing through the air, which has the same effect) is divided, some being directed above the wing and some below it. The air in passing over the curved upper surface is, we might say, "thinned out" or rarified to some extent. The air below the wiry curve remains at about the same density, and therefore the result is that the wing finds less resistance above than below, and lifting occurs. The phenomena is really more complicated than this explanation might indicate, but it gives a general idea of the function of the curved wing.

It will be seen, then, why so many wing contours have been experimented with. Each has its own peculiar traits and constant research is necessary to determine the contour most suitable to the work at hand.

As the lift required for soaring is derived from the movement of the air, naturally there can be no soaring in calm air. As soon as all movement of air ceases soaring quickly ceases and only gliding is possible. This explains the reason that certain localities have been selected by the German soaring plane experimenters, hilly places where air currents are almost continually in motion.

Air currents heated by the sun's rays reflected from the earth, seems to help the lift of a soaring plane. It is a fact that in warmer climates, birds are observed to soar continuously all day, depending absolutely on the air currents which becoming heated and rise, thereby giving motion to the air which in turn imparts the necessary lift to the wings. Soaring birds are unknown in cold climates. It has been observed that soaring is less common as darkness approaches in temperate climates, strengthening the theory that warm air currents are an important requisite for soaring.

(To be continued)

A Model of the Avro "Baby" Aeroplane

The model of the Avro "Baby Green" aeroplane was made from plans appearing in AERIAL AGE, September 1920 by Bruce Allan Mapes of Brooklyn. This ship won the London Aerial Derby, of that year and also flew from London to Turin, Italy a distance of 650 miles in 9½ hours, using only 20 gallons of petrol.

Dimensions of model:

Overall Length	26½"
Overall Height	10½"
Wingspread	37¾"
Wing Chord	5⅞"
Gap	6⅜"
Size of Prop. Diam.	12"
Size of Wheel	3"
Weight	12 ounces
Wing Curve	Sloane

Above: An Avro "Baby" model by Bruce Mapes Below: A 5 H.P. air-propelled ice sled built by H. B. Tonking.

The fuselage is built up from 5/32" longerons of spruce, and made in the standard fashion. I made the fuselage extra strong to stand a good deal of knocking around. The Turtle Deck is built up of Balsa wood framework. Forty feet of ⅛" flat rubber supply the motive power. The landing gear is made from ¼" round reed, with a streamline fairing of Balsa wood. Three inch wooden disc wheels with rubber tires are used with 1/16".

The outside of the wheels are covered with very thin silk and doped. This gives a very good streamline effect. The method of doing this is: the rubber tire is removed and glue or shellac is put on around the rim where the tire was. Spread the silk over the wheel and put on tire again. When the tire is on pull the silk through the opposite side and stretch it evenly all around. When the glue has set, dope the silk several times and you will have a fine streamline disc wheel. This may be done on both sides. The landing gear is also shock absorbing. The nose piece is painted on to correct form. The radiator cowling being painted on. The radiator is put on with white ink, on a black piece of cardboard. This is glued on the front, and then the radiator cowling being painted all around gives it a good effect. A twelve inch propeller is used.

The tail group is constructed in the usual manner with 3/32" reed for the edges, and ⅛" square pine for the frame work. The tail surfaces are movable but not from the pilots cockpit, as in any other models. The tail skid is of ¼" round reed.

The wings are made up of 3/32" reed for the leading and trailing edges, ribs being made of Balsa wood, with Sloane Wing Curve. The ribs of the middle wing is for strength. The wing spars are of ⅛" section and ribs fastened next the fuselage, are made of 1/16" three ply veneer. This spruce, slipped through holes in the ribs at the correct points and glued in place. There are 8 ribs in each lower wing and 7 in each upper wing, and four ribs in the M. W. S. The struts are ⅜" x 3/32" spruce and streamlined. The middle Wing Section Struts are raked outward. The wires are really very thin fishing cord. I think this is better than wire, and is neater and stronger, it is always taut.

The entire model is covered with bamboo paper, and doped with bamboo varnish. The cowling, landing chassis, tail skid and all struts are finished in light blue, the rest of the machine in natural color. The total weight is 12 ounces.

Models Built by Aerial Age Readers

The Curtiss JN4-D model built by R. Hopkins, E. 6th Ave., Redfield, S. D., is not intended to fly but the construction of the large machine is carried out in detail. It was built to the scale of an inch to the foot.

The wings are made in five sections. Spars are of spruce, the ribs are of basswood and are webb construction to secure lightness and to take internal bracing wires. Three-ply veneer is glued to the entering edge of the wings to make it rigid at these points and to keep the covering from pulling in between ribs. Each upper plane is composed of 18 ribs and each lower 14 ribs. There are two stringers thru each wing to secure stiffness. The wings are covered with silk and finished a light brown.

The inter-plane bracing is the same as on the large machine.

The fuselage is built up like the large machine and braced internally with wire, using small aluminum fittings painted black. Seats are leather-padded and have safety belts with small buckles. The following instruments are mounted upon the mahogany instrument board in the rear cockpit: clock, compass, tachometer, airspeed indicator, altimeter, and oil gauge.

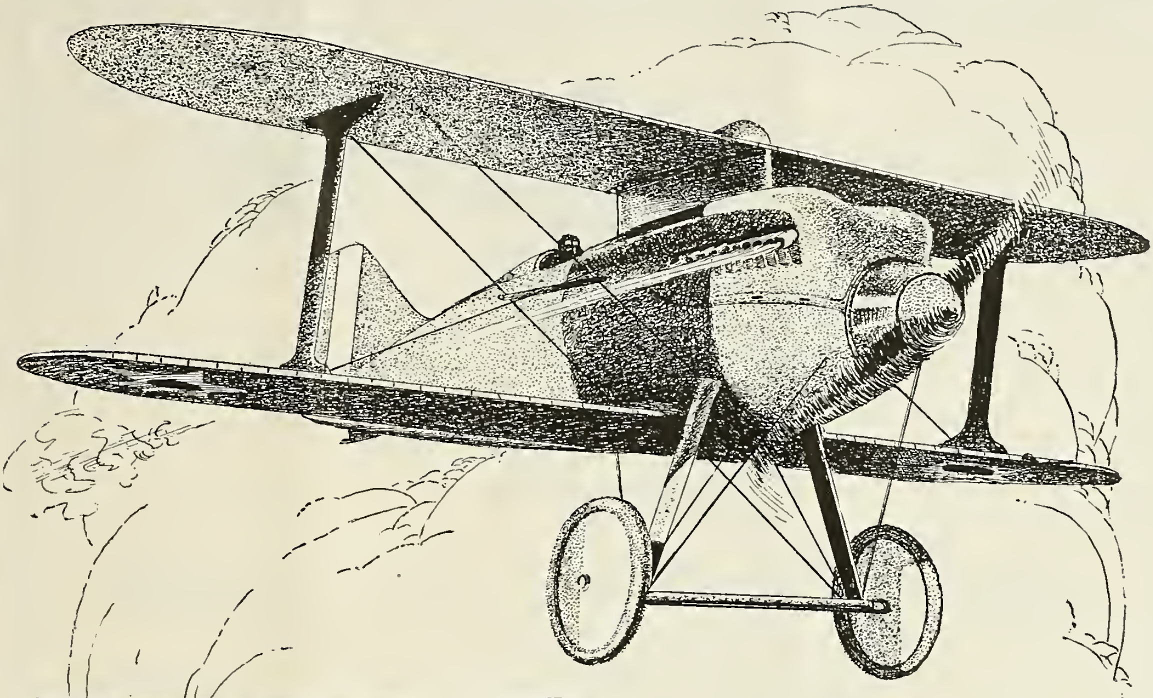
In the rear cockpit there is a throttle lever, switch and hand operated pump that will really pump. The gasoline tank is made of three pieces of brass joined by soldeirng. A miniature gasoline gauge screws on the tank above the cowling. Edges of the cockpits are padded with leather.

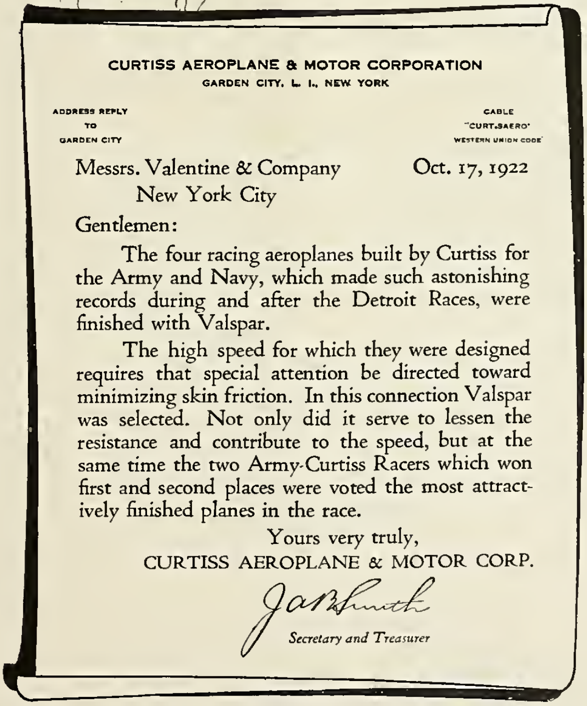
The engine is a dummy OX-5 and is mounted in the engine bed by four small bolts. The crankcase is of wood. The cylinders were made out of rifle bullets of the type used in the army. Small valves and rocker-arms were soldered on the tops. The exhaust pipes are of brass tubing. Intake pipes and a dummy magneto are mounted between the cylinders. Cylinders and crankcase are painted aluminum. The engine cover can be easily removed by unhooking four small lips which hold it tight. The inspection doors swing on two aluminum hinges and are held closed by aluminum clips.

The propeller is eight inches in diameter and is made in five laminations. Radiator is of wood painted gold, the radiating surface being lined with ink.

It is equipped with dual controls. Each elevator aileron and the rudder are hinged by three aluminum hinges. The control horns are of aluminum.

The tail skid and under-carriage are equipped with elastic shock-absorbers.





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The high speed for which they were designed requires that special attention be directed toward minimizing skin friction. In this connection Valspar was selected. Not only did it serve to lessen the resistance and contribute to the speed, but at the same time the two Army-Curtiss Racers which won first and second places were voted the most attractively finished planes in the race.

Yours very truly,
CURTISS AEROPLANE & MOTOR CORP.

Secretary and Treasurer

Faster than Human ever flew—and Valspar helped!

New honors for Curtiss Planes! First four places in the Pulitzer Trophy classic, with the winner averaging 206 M. P. H. over the 160 mile course—a new world's record. That was October 14th at Selfridge Field, Michigan.

October 16th another record went crashing. Lieut. R. L. Maughan, winning pilot in the Pulitzer contest attained the terrific speed of 248.5 M. P. H. over the one-kilometer course. Two days later Brigadier General Mitchell set an official world's record of 224.05 M. P. H. on the same course.

How important a part Valspar played in these victories is disclosed by the accompanying letter from the Curtiss Aeroplane and Motor Company. 100% waterproof, weather-proof and wearproof, Valspar is in a class by itself. It has no equal.

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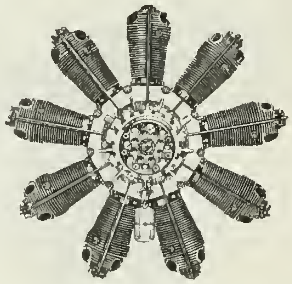

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is the only aero engine in the world which has passed the Type Tests of both the British and French Air Ministries

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"Nothing to report. The engine behaved itself perfectly. There were no replacements of any sort in the course of the trials.

"It is regrettable that this test stops at 50 hours; this duration could have been doubled, which would have been a still better testimony to the engine."

BRITISH AIR MINISTRY TYPE Test, September, 1922

The Jupiter engine was the first air-cooled engine to pass this test, which comprised 50 hours' endurance test at 90 per cent. full power, one hour high speed, one hour high power, runs for power curve, etc. At the conclusion of these tests one hour was run at full throttle at 1,775 r.p.m., averaging 442 B.H.P., and one hour at 1,840 r.p.m., averaging 450 B.H.P.

FRENCH AIR MINISTRY TYPE Test, JUNE, 1922

The tests carried out at Gennevilliers included five non-stop runs of 10 hours each duration, the first half-hour of each period at full power, 9½ hours at 90 per cent. full power, with 2 minutes at full power at the close of each period. The average power recorded at the beginning of the periods was 413 B.H.P., and at the end 420 B.H.P.

The oil consumption was only 10½ pints per hour, and for the first time in the history of the French official tests the whole of the tests were carried out in 10-hour periods without adjustments or replacements of any kind.

The Bristol Aeroplane Company, Ltd.
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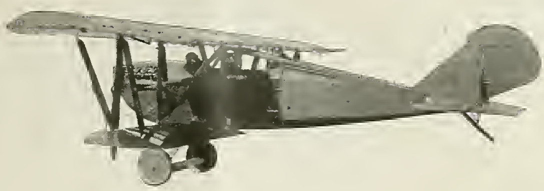

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Height	**9′ 00″**	**9′ 00″**
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Weight Empty	**1125 Pounds**	**1215 Pounds**
Useful Load	**735 Pounds**	**750 Pounds**
Radius	**300 Miles**	**350 Miles**
Climb in 10″	**4500 Feet**	**8000 Feet**
Ceiling	**12000 Feet**	**18000 Feet**
Maximum Speed	**90 MPH**	**110 MPH**
Minimum Speed	**35 MPH**	**38 MPH**

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(Concluded from page 604)

NOTE: Testing and Experimental Work at College Park, Md., discontinued December 31, 1921.

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- Office Force and Watchmen
- Motor Cycles and Trucks
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- Miscellaneous
- Mechanics and Helpers
- Repairs and Accessories
- Warehouse

FLYING CONSISTS OF:
- Gasoline and Oil
- Pilots

SERVICE AND UNIT COST

Month	Gal. of Gas	Time Hr.	Time Min.	Miles Flown	Cost per Hour	Cost per Mile
1921						
July	48,625	1644	26	148684	66.76	0.73
August	47,818	1696	30	149432	63.06	0.71
September	43,953	1667	07	148099	61.73	0.79
October	46,469	1779	32	158971	68.58	0.77
November	41,758	1602	31	143145	73.27	0.82
December	39,576	1532	26	141256	76.17	0.84
1922						
January	38,755	1491	22	137687	78.15	0.85
February	34,343	1274	58	118084	68.15	0.74
March	41,532	1640	20	150664	58.35	0.64
April	37,810	1453	53	134003	56.06	0.60
May	41,022	1585	39	149285	50.22	0.53
June	40,970	1668	09	147955	47.05	0.53
Totals & Averages	205,631	19036	53	1727265	63.83	0.7035

COST PER MILE

Month	Overhead	Flying	Maintenance	
1921				
July	.18	.22	.33	
August	.16	.22	.33	
September	.17	.21	.32	
October	.20	.20	.37	
November	.20	.21	.41	
December	.20	.21	.42	
1922				
January	.20	.20	.45	
February	.21	.22	.31	
March	.16	.19	.29	
April	.17	.21	.22	
May	.15	.19	.19	
June	.17	.19	.17	
Averages	.1783	.2058	.3194	
Total				.7035

PAUL HENDERSON,
Second Asistant Postmaster General

AIRCRAFT YEAR BOOK

Edition of 1922

Published by Aeronautical Chamber of Commerce of America, Inc.

250 Pages Text; 40 Pages Illustrations; 40 Pages Aircraft and Engine Drawings

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